Umatilla National Forest

Aquatic Restoration Project

Fisheries Biological Evaluation & Hydrology Report

Prepared by:

/s/ Joy Archuleta
Joy Archuleta; Forest Hydrologist

/s/Tracii Hickman
Tracii Hickman; Forest ESA Biologist

For:
Umatilla National Forest

Date: 6/14/2018 8:34:30 PM

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Introduction

The Proposed Action, of which this Hydrology and Fisheries Biological Evaluation (Fish BE) report will analyze, includes a number of individual actions that, when grouped together, represent Aquatic Restoration programs and projects that may occur across the Umatilla National Forest. This analysis approach provides the Umatilla National Forest with a consistent methodology to design, implement, monitor and document aquatic restoration activities. ..

Relevant Laws, Regulations, Policies, Guidance and Plans

Management direction contained in the Umatilla Land and Resource Management Plan (1990) is the basis for the protection and recovery of water quality. The "Management Direction" and the "Standards and Guidelines" in the management plan identify the types of activities appropriate within each land use allocation. The Forest plan includes specific riparian management direction to protect water quality and many of the Standards and Guidelines effectively serve as general best management practices (BMPs) to prevent or reduce water pollution to meet the goals and requirements of the federal Clean Water Act.

PACFISH (USDA and USDI 1995b) and INFISH (USDA and USDI 1995a) were implemented in response to the potential listing under the Endangered Species Act of several anadromous and resident fish species in the Snake River and interior portions of the Columbia River basin and included measures that were intended to halt further degradation of the habitats of these species on federal lands. Only PACFISH applies to the Umatilla NF due to the presence of anadromous fisheries. Adherence to the Standards and Guidelines of the Forest plans as amended by the PACFISH strategy includes the designation and protection of riparian habitat conservation area (RHCAs). PACFISH includes goals and objectives for management of RHCAs, and standards and guidelines for land management activities, among other requirements.

Subsequently, the Forest Service developed the Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2018) as guidance intended to provide a regionally consistent approach to the management of watersheds and riparian and aquatic habitats. The rationale for the ARCS was based on lessons learned from 25 years of successful implementation of PACFISH, INFISH, and the Northwest Forest Plan (FEMAT 1993).

PACFISH Goals, Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs)

PACFISH (1995b) was a broad conservation strategy developed to address declining populations of fish populations and establish characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. Since the quality of water and fish habitat in aquatic systems is inseparably related to the integrity of upland and riparian areas within the watersheds, the strategy identifies several goals for watershed, riparian, and stream channel conditions.

The three components of PACFISH; Goals, Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs) are designed to work in concert to protect and improve conditions for watersheds and aquatic species. A brief description of Goals, RMOs and RHCAs follows, for a more complete description see PACFISH (1995b).

The Goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. Since the quality of water and fish habitat in aquatic systems is inseparably related to the integrity of upland and riparian areas within the watersheds, the strategy identifies several goals for watershed, riparian, and stream channel conditions.

Riparian Management Objectives provide criteria to help assess attainment of aquatic and riparian goals. RMOs provide a characterization of the existing condition of the watershed, riparian and stream channel processes that can be used to guide management.

Riparian Habitat Conservation Areas are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines.

Standard Widths Defining Interim RHCAs

The four categories of stream or water body and the standard widths for each are:

Category 1 - Fish-bearing streams: Interim RHCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

Category 2 - Permanently flowing non-fish-bearing streams: Interim RHCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

Category 3 - Ponds, lakes, reservoirs, and wetlands greater than 1 acre: Interim RHCAs consist of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.

Category 4 - Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide-prone areas: This category includes features with high variability in size and site-specific characteristics. At a minimum the interim RHCAs must include:

a. the extent of landslides and landslide-prone areas

b. the intermittent stream channel and the area to the top of the inner gorge

c. the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation

d. for Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest

e. for watersheds not identified as Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one-half site potential tree, or 50 feet slope distance, whichever is greatest

In non-forested rangeland ecosystems, the interim RHCA width for permanently flowing streams in categories 1 and 2 is the extent of the 100-year flood plain.

Aquatic and Riparian Conservation Strategy (ARCS)

The 2018 Aquatic and Riparian Conservation Strategy (ARCS) is a further refinement of PACFISH and is Regional direction for National Forests revising their land management plans. The ARCS is designed to maintain and restore the ecological health of watersheds and aquatic and riparian ecosystems on National Forest System (NFS) lands in the Pacific Northwest Region

ARCS integrates and refines the PACFISH/INFISH strategies building upon prior successes, reflecting new science and policy, incorporating lessons learned, and addressing ongoing issues and new needs. The ARCS combines ecosystem and landscape perspectives to provide a management strategy focusing first and foremost on broad-scale aquatic resource conservation and protection, coupled with strategically-focused active restoration in priority areas (USDA 2018).

The Watershed Condition Framework (WCF) process will continue under both the existing and the revised Umatilla Land Management Plan currently in development. The WCF will be utilized to develop and implement the watershed restoration program in a structured, efficient and effective manner. The selected priority subwatersheds are the focus for the forest’s aquatic restoration program.

The Forest Aquatic Restoration EA will provide flexibility to improve aquatic habitat in yet unidentified priority subwatersheds as well as allowing opportunistic restoration outside these areas where there is benefit to water quality and aquatic habitat.

Watershed Condition Framework

The 2011 Watershed Condition Framework (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands (Figure 1). The WCF was implemented across all National Forests to improve the Forest Service approach to watershed restoration by establishing a consistent methodology for condition assessment, and targeting the implementation of integrated collections of enhancement activities on those watersheds identified as priorities for restoration (USDA 2011).

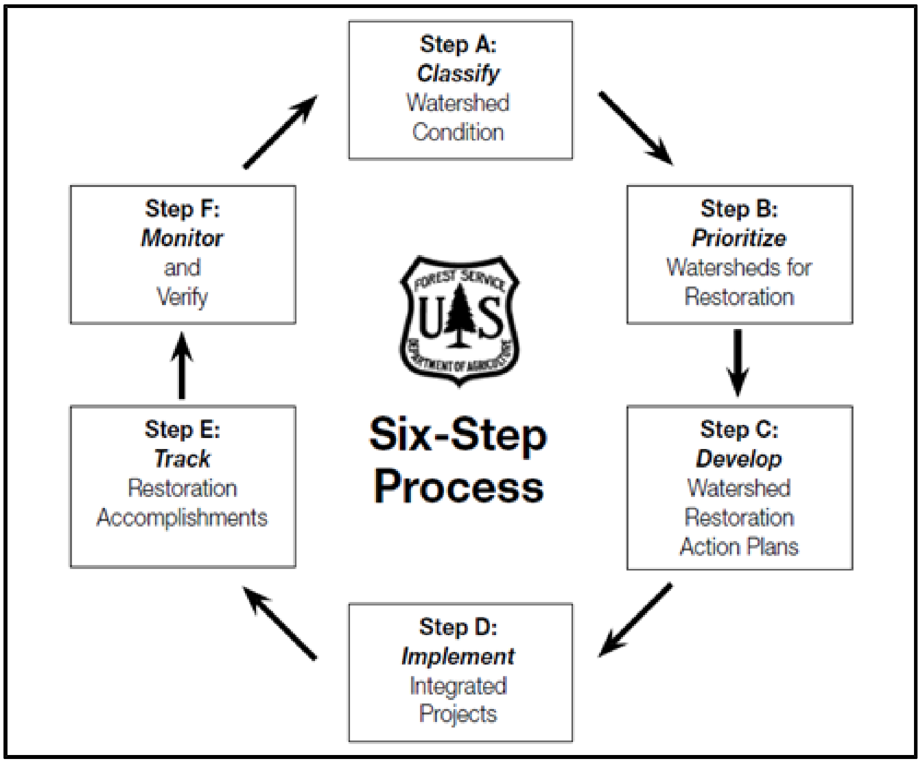

Figure 1: Six-Steps of the Watershed Condition Framework (WCF) process.

Prior to the WCF each national forest classified watershed condition (typically at the watershed, or HU5, scale) using local methods that were not consistent between forests. The WCF provides a framework for consistent assessments at the subwatershed, or HU6 scale, and for prioritizing watersheds for restoration.

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity. The WCF classifies watershed condition using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition.

The indicators are grouped according to four major process categories: (1) aquatic physical, (2) aquatic biological, (3) terrestrial physical, and (4) terrestrial biological (fig.1). These categories represent terrestrial, riparian, and aquatic ecosystem processes or mechanisms by which management actions can affect the condition of watersheds and associated resources. The four "process categories" are then weighted to reflect their relative contribution toward watershed condition from a national perspective. The aquatic physical and aquatic biological categories are weighted at 30% each because of their direct impact to aquatic systems (endpoint indicators). The terrestrial physical category was weighted at 30% because roads are one of the greatest sources of impact to watershed condition. The terrestrial biological category is weighted at 10% because these indicators have less direct impact on watershed condition.

Primary emphasis is placed on aquatic and terrestrial processes and conditions that Forest Service management activities can influence. The approach is designed to promote integrated watershed assessments; target programs of work in watersheds that have been identified for restoration; enhance communication and coordination with external agencies and partners; and improve reporting and monitoring of program accomplishments.

Aquatic Restoration Assessment and Biological Opinion

Matrix of Pathways and Indicators

The Aquatic Restoration Biological Assessment (ARBA II) (USDA Forest Service et al 2013) and associated Aquatic Restoration Biological Opinions (USDC NMFS 2013 and USDA FWS 2013) (hereafter referred to as ARBO II collectively) were originally prepared in 2007, then updated in 2013, to facilitate restoration of aquatic habitats and watersheds on National Forest System (NFS) and Bureau of Land Management (BLM) lands in Oregon and Washington. Federal agencies involved in the conservation and restoration of aquatic species and watersheds recognized the need of a strategic process that consistently implemented categories of restoration of projects on FS and BLM lands.

The programmatic approach of ARBA II and ARBO II allows a streamlined ESA consultation approach using a required set of design elements and project design criteria. This approach results in a predictable and consistent set of effects from project implementation, and a consistent approach to project design and implementation. ARBA and ARBO provides a unified approach to identifying programmatic activity categories, project design criteria, and reporting within and amongst action agencies, resulting in improved communication and project implementation. The streamline consultation approach reduces the planning costs which allows for more on-the-ground restoration.

Each of the ARBA II aquatic restoration categories in the Proposed Action may have varying degrees of direct and indirect effects to aquatic and terrestrial ESA-listed species and their Critical Habitat (CH) and Essential Fish Habitat (EFH). Direct effects cause an immediate impact. Indirect effects are those effects that occur later in time. Effects of most concern under this programmatic consultation are those resulting from short-term habitat removal or degradation or impacts that cause changes to listed species' growth, reproduction, and survival. The aquatic conservation measures and project design criteria listed in Chapter II are intended to minimize potential adverse direct and indirect project effects to ESA/MSA listed species, CH, and EFH.

The effects of restoration activities on individual fish, CH, and EFH are described in context of the Matrix of Pathways and Indicators (MPI) developed by the FWS and NOAA Fisheries (1996 and 1999). The objective of process is to integrate the biological and habitat conditions to arrive a determination of the potential effect of land management activities on a proposed or listed species.

The protocol looks at a suite of indicators ranging from in-channel to watershed-scales that are known to influence habitat quantity and quality for fish and associated aquatic species, where the species of interest is known to be present. Effects of project activities are then assessed to determine whether the project would have a negative, neutral or positive effect on individual indicators, that would shift resulting indicator conditions to change to a new value that would place the indicator into a new category as a result of the project, resulting in a measurable effect to the listed species in question.

The effects of the programmatic actions will be analyzed using the Matrix of Pathways and Indicators. The following Pathways (***Italic Bold***) and their indicators were used in this analysis:

- **a)** ***Water Quality:*** 1) Temperature; 2) Turbidity; 3) Chemical Contamination/Nutrients
- **b)** ***Habitat Access:*** 4) Physical Barriers
- **c)** ***Habitat Elements:*** 5) Substrate/Sediment; 6) Large Wood; 7) Pool Frequency and Quality, 8) Off-Channel Habitat; 9) Refugia
- **d)** ***Channel Condition and Dynamics:*** 10) Width/Depth Ratio; 11) Streambank Condition; 12) Floodplain Connectivity
- **e)** ***Flow/Hydrology:*** 13) Changes in Peak/Base Flows; 14) Increase in Drainage Network
- **f)** ***Watershed Condition:*** 15) Road Density and Location; 16) Riparian Reserves; 17) Disturbance History
- **g)** ***Fish:*** 18) Fish Population Characteristics

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Hydrology – Affected Environment

Existing Condition

During the last 150 years, watershed conditions in the Blue Mountains have been altered by a series of human uses, including mining, logging, agriculture, water diversions, flood control, wildfire exclusion, grazing, road construction and maintenance, and hydro-electric development. The combined impacts of past land uses include, but are not limited to changes in vegetative conditions, simplification and loss of aquatic habitats, increases in sediment delivery to streams, and degradation of riparian and floodplain functions (McIntosh et al. 1992, Wissmar 2004). The resulting degradation and fragmentation of aquatic and riparian habitats and impacts to water quality contributed to declines or outright extinction of many resident and anadromous fish stocks, the listing of several fish stocks under the Endangered Species Act, and the listing of many streams as water quality impaired beginning in the early 1990s.

Exceedance of State water quality temperature standards is the most common water quality issue. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Chemical use in state, federal, and private forest lands have resulted in the introduction of pollutants to headwater stream segments. The three major categories of forest chemical used are pesticides, fertilizers, and fire retardants. While pesticide use in all forest ownership types was extensive during the 1970's and 1980's, application rates on National Forest System lands peaked in the mid 1980's, and have decreased considerably since.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Irrigation is a widespread practice in Southeast Washington and Eastern Oregon. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for some ESUs that have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, floodplains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil, thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the area's habitat and land-use changes. Federal lands are generally forested and situated in upstream portions of the watersheds. While there has been substantial habitat degradation across all land ownerships, including Federal lands, in general, habitat in many headwater stream segments is in better condition than in the largely non-federal lower portions of tributaries. In the past, valley bottoms were among the most productive fish habitats in the basin. Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valleys and lower elevation areas. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

Water Quality

Water produced within the Umatilla National Forest is generally of high quality. Monitoring programs include a network of stream temperature sensor sites and sediment sampling in selected streams as part of project and/or long-term effectiveness monitoring. The most persistent and widespread water quality concern is high stream temperatures during low stream flows in summer. High summer air temperatures, changes in stream surface shading caused by legacy Forest Service management activities, and low flows are important factors contributing to warmer water. Sediment levels in streams vary significantly with stream flows, with the highest levels during winter and spring runoff. Some stream reaches show evidence of sediment accumulation from varying sources, such as local stream bank erosion or contributing watershed conditions (e.g., high sediment-producing geology and roads close to streams). Sediment accumulation is a natural function in lower gradient streams, but some areas show evidence of sediment accumulation from past and ongoing management activities. Other water quality concerns that have been observed include nutrient and bacteria sources from livestock, wildlife, and recreation uses. Impacts generally occur during times of concentrated use (at concentrated use areas).

Water quality has improved in recent years as a result of changes in management motivated by direction in PACFISH and INFISH, implementation of water quality best management practices (BMPs), direction in the Regional Aquatic Restoration Strategy, fish recovery plans, and through partner investments. Examples include increased emphasis on protecting streamside areas to reduce impacts to shade producing vegetation, and repairing and removing unstable roads. At the project level, Forest Service staff design and implement a wide variety of BMPs as part of land management activities. Monitoring occurs on a sample of practices to determine BMP implementation and effectiveness and need for adjustment. Monitoring of road decommissioning and stabilization conducted by the Rocky Mountain Research Station since 2008 has assessed treatment effectiveness in reducing impacts to aquatic ecosystems. Monitoring results indicated treatments reduced erosion and sediment delivery and lowered risk to aquatic ecosystems.

Impaired Waters

Water bodies on the UNF support designated beneficial uses, which include domestic and agricultural, cold-water fisheries, recreation, domestic livestock, and wildlife uses. Maintaining the quality of these waters is becoming increasingly important as the demand for clean water resources increases and the timing and volume of surface runoff changes in responses to climate change. Water quality criteria designed to protect the designated uses and are used to assess the general health of surface waters.

Beneficial uses for waterbodies within the state of Oregon are located at

http://www.oregon.gov/deq/wq/Pages/WQ-Standards-Uses.aspx

Washington state beneficial uses can be found at

http://www.ecy.wa.gov/programs/wq/swqs/desig_uses.html.

Section 303(d) of the 1972 Federal Clean Water Act requires the identification of water bodies that violate water quality standards and thereby fail to fully protect beneficial uses. Streams that do not meet water quality standards and thereby do not protect designated beneficial uses are referred to as impaired and are included on state 303d lists. The law requires that states develop total maximum daily loads (TMDLs) for these waters that address the sources of pollution and identify actions needed to improve water quality. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs establish load allocations that are expected to provide conditions that meet state water quality standards over time.

The maintenance of the 303(d) list is an ongoing process and is updated periodically based on new information. Oregon Department of Environmental Quality (DEQ) submitted Oregon's 2012 Integrated Report and 303(d) list to EPA in November 2014. EPA approved most of the submitted 303(d) listings and delistings in December 2016. The approved 303(d) list with EPA's modifications is currently effective for Oregon. DEQ will update the searchable database when EPA has completed final action to add other impaired waters to Oregon's 303(d) list. The approved 2012 303(d) list is currently effective for Clean Water Act purposes within Oregon[1]. The current water quality assessment and 303(d) list of impaired waterbodies for the state of Oregon can be obtained from the following website:

http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp

The Environmental Protection Agency (EPA) approved Washington Department of Ecology's (DOE) submittal of the latest 303(d) list on July 22, 2016. The current water quality assessment and 303(d) list of impaired waterbodies for the state of Washington can be obtained from the following website:

http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html

The most common water quality impairment on Umatilla National Forest is for exceedance of stream temperature standards criteria. Because the concentration of dissolved oxygen in water is temperature dependent, streams with high water temperatures often have correspondingly low dissolved oxygen levels, which is detrimental to beneficial uses (cold water fish species). Sources of temperature impairment identified in TMDLs by ODEQ include loss of stream shade, changes in channel morphology, loss of floodplain and shallow groundwater connection, and changes in streamflow. ODEQ recognizes that stream shade provided by riparian vegetation has the most widespread achievable effect on reducing stream temperatures by reducing direct solar radiation. This emphasis on shade shows the importance of restoring healthy communities of riparian vegetation. The agencies recognize that changes in channel morphology are often more costly and take longer to achieve results. ODEQ has administrative procedures for transferring water rights from out-of-stream uses to instream flows for benefit of water quality, aquatic species, and recreation uses.

The US Forest Service is recognized by the states as the land manager with authority to manage and regulate sources of pollutants on the Umatilla National Forest lands. As the designated management agency, the Forest Service is responsible for developing water quality restoration plans that outline the BMPs and restoration strategies needed to restore water quality in impaired waters and reduce pollution to surface waters in National Forest System lands. The Forest Service has contributed to the development of TMDLs by providing relevant data and technical assistance for streams within the Umatilla National Forest and has participated in technical and stakeholder groups (Table 1).

[1] Pending judgement on litigation and EPA's final action on Oregon's 2012 303(d) list have implications to water quality status on NFS lands (Northwest Environmental Advocates v. U.S. Environmental Protection Agency). This report is based on the current status of temperature 303(d) listings, TMDL, WQRP, FS programs, plans and actions intended to protect water and restore water quality. For purposes of NEPA the 2012 list is the effective list at this time. It is anticipated that under this ruling TMDLs, WQRPs and planning documents will be updated to be compliant with the resulting judgement. TMDLs affected by this litigation on the UNF include the John Day River basin, Willow subbasin, and Lower Grande Ronde subbasin.

Table 1: Status of total maximum daily loads (TMDLs) and water quality restoration plans (WQRPs)

		TMDL Date	Water quality Parameters	Implementation Plan
Oregon	John Day Basin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Basin-John-Day.aspx	2010	Temperature, Bacteria, Dissolved Oxygen	WQRP completed in 2014
	Upper Grande Ronde Subbasin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Basin-Grande-Ronde.aspx	2000	Temperature, Bacteria, DO, pH, Ammonia, Sedimentation	Federal lands included in WQMP
	Lower Grande Ronde Subbasin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Basin-Grande-Ronde.aspx	2010	Temperature, Bacteria	Federal lands included in WQMP
	Umatilla Basin – Umatilla Subbasin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Umatilla-Basin.aspx	2001	Temperature; Sediment; Aquatic Weeds, Algae and pH; Nitrate, Ammonium, Bacteria	Federal lands included in WQMP
	Umatilla Basin - Walla Walla Subbasin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Umatilla-Basin.aspx	2005	Temperature	FS lands included in TMDL. WQRP submitted in 2008.
	Umatilla Basin - Willow Subbasin https://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Umatilla-Basin.aspx	2007	Temperature, pH, Bacteria	FS lands included in TMDL
Washington	Tucannon River and Pataha Creek http://www.ecy.wa.gov/biblio/1010019.html	2010	Temperature	FS not included in TMDL, management requirements
	Walla Walla Watershed Multiparameter http://www.ecy.wa.gov/programs/wq/tmdl/WallaWallaTMDL.html	2007	Temperature	FS not included in TMDL, management requirements

The Tucannon and Walla Walla TMDLs do not address the national forests in the Washington State TMDL Implementation plans, however, they do recognize the FS as a DMA and acknowledge programs and progress towards improving water quality including forest plan management requirements under PACFISH, coordinated monitoring and restoration activities. ODEQ does address the Umatilla National Forest in the Walla Walla Subbasin within Oregon. The Forest Service participated in and contributed to the development of the OR Walla Walla TMDL and Water Quality Management Plan.

Climate Change Effects on the Aquatic Environment

Increasing air temperatures, decline in snowpack and changes in the magnitude and timing of rainfall are expected to reduce summer streamflow, increase cool season streamflow, and increase stream temperatures at least during the next century throughout the Pacific Northwest. These changes in streamflow and temperature have the potential to directly impact aquatic habitat and organisms. For example, bull trout and salmon populations may be directly impacted and could decline through these anticipated changes. Changes in the timing of streamflow and scouring of stream habitat due to increased rain on snow events are expected to affect the quality and quantity of habitat for aquatic species and the development and timing of emergence of aquatic insects (Mantua et al. 2010).

Management strategies to increase the adaptive capacity of aquatic ecosystems in the face of climate change include:

Reducing potential increases in stream temperatures through riparian buffers

Restoring and the maintaining effective stream shade

Reducing the risk of water quality degradation and increasing aquatic connectivity by:

Decreasing road density

Reducing hydrological connectivity of the road system

Replacing culverts

Closing, realigning, or obliterating roads

The ability to maintain existing high quality habitats and to restore degraded habitats will be influenced by climate change over the next several decades with projected higher average air temperatures, more winter precipitation falling as rain versus snow, and diminishing winter snow packs resulting in earlier snowmelt. Changes in runoff volume and lower summer base flows, higher surface water temperatures, and likely greater year-to-year variability in precipitation could also result in extended drought periods and more severe floods than have occurred in recent history. Changes in timing and amount of runoff associated with climate change affect every resource, including terrestrial vegetation, wildlife, riparian and aquatic species, and water availability for human use.

Watershed Condition Framework Ratings on the Umatilla National Forest

On the Umatilla NF, there were 127 subwatersheds included in the assessment. National forest ownership within subwatersheds ranged from 5-100 percent (watersheds with less than 5 percent national forest lands were not rated). Assessment data came from the national forests so ratings apply only to the national forest lands in the watershed.

Table 2: **Overall Watershed Condition Ratings on the Umatilla NF by HU4 Subbasin – Number of HU6 Subwatersheds by Condition Class.**

	Subbasin HUC #	*Number of Subwatersheds*		
		Good Functioning Properly	**Fair Functioning at Risk**	**Poor Impaired Function**
Upper Grande Ronde	17060104	4	5	0
Lower Grande Ronde	17060106	21	1	0
Lower Snake - Asotin	17060103	4	1	0
Lower Snake - Tucannon	17060107	3	3	0
Walla Walla	17070102	6	4	0
Umatilla	17070103	12	5	0
North Fork John Day	17070202	18	27	0
Middle Fork John Day	17070203	2	0	0
Lower John Day	17070204	4	4	0
Willow	17070104	2	1	0

Ratings for most indicators show varying distributions of functioning properly, functioning at risk, and impaired function (Figure C). Four indicators most relevant to water quality and fisheries are discussed in more detail; water quality, aquatic habitat, riparian/wetland vegetation, and roads & trails.

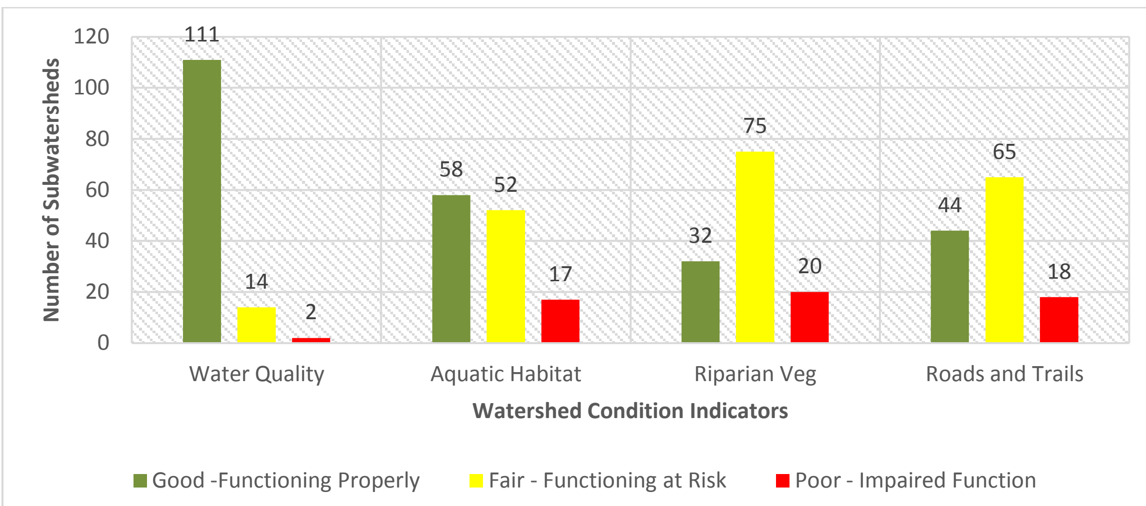


Figure 2: Number of subwatersheds by condition class for selected indicators.

A rating of "good" indicates the subwatershed has a high geomorphic, hydrologic and/or biotic integrity relative to the natural potential condition and suggests the watershed is functioning properly with respect to that indicator. In contrast, a rating of "poor" suggests that the subwatershed has impaired function. WCF "properly functioning", "functioning-at-risk", or "impaired function" descriptions are equivalent to "functioning appropriately", "functioning-at-risk" and "functioning at unacceptable risk" categories within the matrix of pathways and indicators (MPI) used by USFWS (USDI Fish and Wildlife Service 1998) and to "properly functioning" or "at-risk" or "not properly functioning" categories within the MPI used by NMFS (NMFS 1996).

Overall Watershed Condition

Overall watershed condition on the Umatilla NF was rated "good" in 76 watersheds (60%) and "fair" in 51 watersheds (40%). None of the evaluated watersheds was rated in "poor" condition.

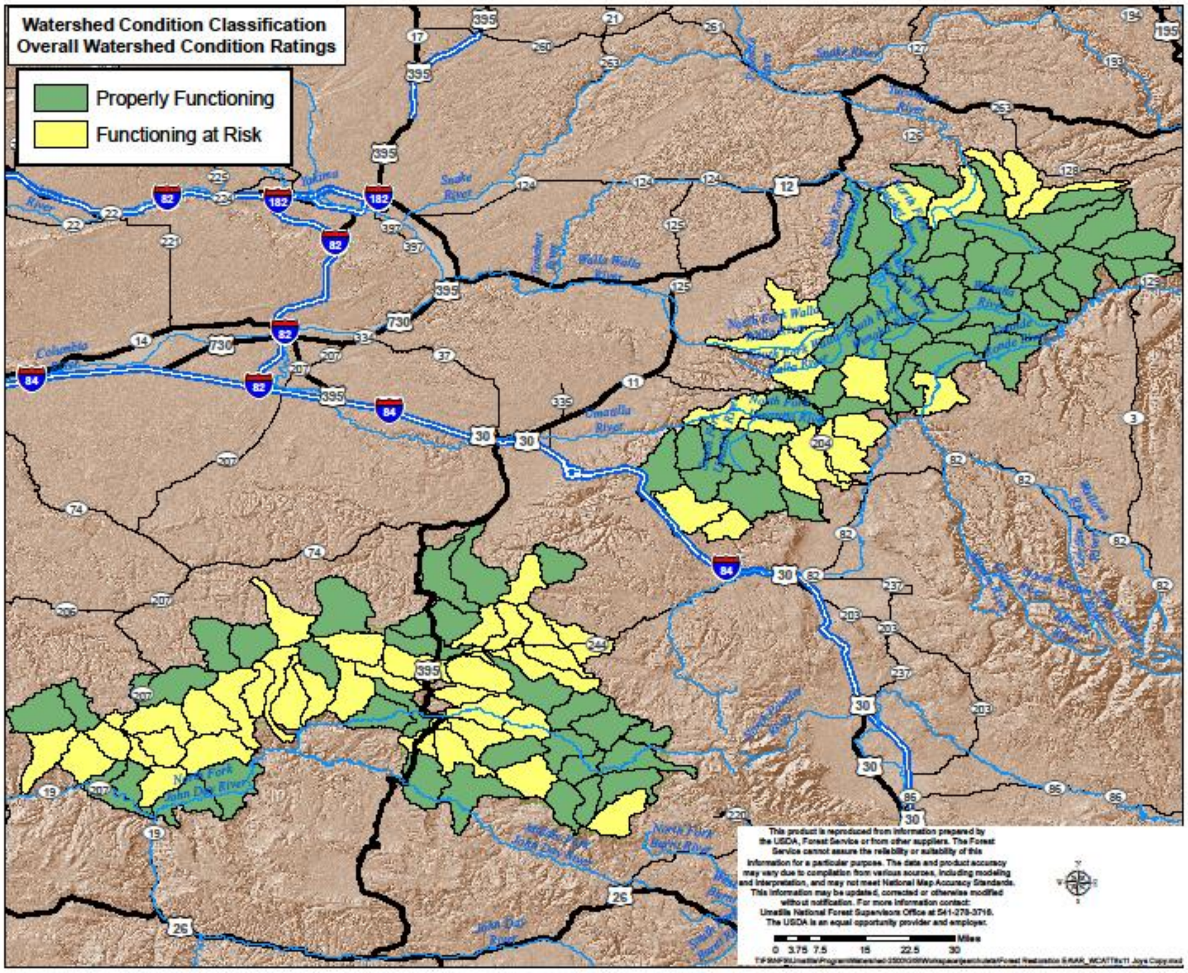


Figure 3: Overall Watershed Condition Class for subwatersheds on the Umatilla NF.

Water Quality

The water quality indicator assesses the impairment to beneficial uses of water bodies in the subwatersheds. For water quality, 111 subwatersheds were rated good, 14 fair, and 2 were rated in poor condition. When a Total Maximum Daily Load (TMDL) is established for a pollutant, a Water Quality Management Plan (WQMP) is developed to identify management actions to address the pollutant and improve water quality. This attribute rating is based on 303(d) status during the 2015 reassessment of the WCF and reflects listings not covered under a current TMDL/WQRP.

Table 3: Water quality condition rating rule.

Attributes	Good (1) Functioning Properly	Fair (2) Functioning At Risk	Poor (3) Impaired
Water Quality Condition Indicator	Minimal to no impairment of beneficial uses to the water bodies in the watershed.	Minor impairment of beneficial uses to the water bodies in the watershed.	Significant impairment of beneficial uses to the water bodies in the watershed.
Impaired Waters (303d Listed)	No State listed impaired or threatened water bodies.	Less than 10% of the stream miles or lake area are listed on the 303d or 305b lists and not supporting beneficial uses.	10% or more of the stream miles or lake areas are water quality limited and not fully supporting beneficial uses as identified by a State Water Quality Agency integrated report (303d & 305b).
Water Quality (Not Listed)	The watershed has minor or no water quality problems. For example, no documented evidence of excessive sediment, nutrients, chemical pollution or other water quality issues above natural or background levels; no consumption advisories or contamination from abandoned or active mines; little or no evidence of acidification, toxicity, or eutrophication due to atmospheric deposition (see “Additional Guidance” related to mines and atmospheric deposition).	The watershed has moderate water quality problems. For example, consumption advisories in localized areas; minor contamination from active or abandoned mines; localized incidence of accelerated sediment, nutrients, chemicals, or infrequent, documented incidents of water contamination of public drinking water sources. Moderate evidence of acidification, eutrophication, or toxicity due to atmospheric deposition (see “Additional Guidance” elated to mines and atmospheric deposition).	The watershed has extensive water quality problems. For example, consumption advisories over extended areas; excessive sediment, nutrients, chemicals, extensive contamination from active or abandoned mines; or frequent incidents of contamination in public drinking water sources. Strong evidence of acidification, eutrophication, or toxicity due to atmospheric deposition (see “Additional Guidance” related to mines and atmospheric deposition).

Aquatic Habitat

The aquatic habitat indicator rating reflects whether the subwatershed supports large continuous blocks of high-quality habitat and high-quality stream channel conditions. Seventeen subwatersheds rated poor condition based on habitat quality, fragmentation and stream channel condition. Watersheds in "poor condition" for aquatic habitat largely reflect legacy (past) land uses (i.e. grazing, mining, logging), including fragmentation by roads, lack of large wood in channels, and altered channel morphology. Many of these conditions continue to persist long after the original impact. There were 52 subwatersheds rated in fair condition and 58 in good condition. Seventeen are in poor condition.

Table 4: Aquatic habitat condition rating rule.

Attributes	Good (1) Functioning Properly	Fair (2) Functioning at Risk	Poor (3) Impaired
Aquatic Habitat Condition Indicator	The watersheds supports large continuous blocks of high quality aquatic habitat and high quality stream channel conditions.	The watersheds supports medium to small blocks of contiguous habitat. Some high quality aquatic habitat is available, but stream channel conditions show signs of being degraded.	The watershed supports small amounts of continuous high quality aquatic habitat. Most stream channel conditions show evidence of being degraded by disturbance.
Habitat Fragmentation (including Aquatic Organism Passage)	Fragmentation of habitat is not a serious concern (>95% of historical aquatic habitats are still connected).	Aquatic habitat fragmentation is increasing due to temperature, aquatic organism passage blockages, or dewatering (only 25% - 95% of the historical aquatic habitats are still connected).	Aquatic habitat fragmentation due to temperature, blockages, or dewatering is a serious concern (>25% of the historical aquatic habitats are no longer connected).
Large Woody Debris	In aquatic and riparian systems that evolved with wood, large woody debris is present and continues to be recruited into the system at near natural rates.	In aquatic and riparian systems that evolved with wood, large woody debris is present but is recruited into the system at less than natural rates due to riparian management activities.	In systems that should contain large wood as an ecosystem component, it is lacking resulting in poor riparian or aquatic habitat conditions including bank destabilization, little pool formation, and little microclimate maintenance.
Channel Shape and Function	Channel width-to-depth ratios exhibit the range of conditions expected in the absence of human influence. Less than 5% of the stream channels show signs of widening. Channels are vertically stable, with isolated locations of aggradation or degradation as would be expected in near natural conditions. The distribution of channels with floodplain connectivity is close to that found in reference watersheds of similar size and geology.	Channel width-to-depth and vertical stability are maintained except where riparian vegetation has been disturbed. From 5 to 25% of the stream channel have seen an increase in width-to-depth ratios. Channel degradation and/or aggradation are evident but limited to relatively small sections of the channel network. Evidence of downcutting so that some stream channels are no longer connected to their floodplain.	More than 75% of channels have width-to-depth ratios greater than expected under near-natural conditions. The size and extent of gullied sections of channels are extensive, currently increasing, or have increased recently. Many streambanks show signs of active erosion above that expected naturally. Channel degradation and/or aggradation are evident and widespread due to unstable streambed and banks. Many (>50%) of the stream channels are disconnected from their floodplain or are braided channels due to increased sediment loads

Riparian Vegetation

The riparian vegetation indicator addresses the function and condition of native riparian vegetation. Twenty subwatersheds were rated poor based on relative condition and departure from potential. As with aquatic habitat, riparian conditions also reflect legacy land uses no longer active or allowed (such as streamside logging). There were 32 subwatersheds rated in fair condition and 75 in good condition.

Table 5: Riparian and wetland vegetation condition rating rule.

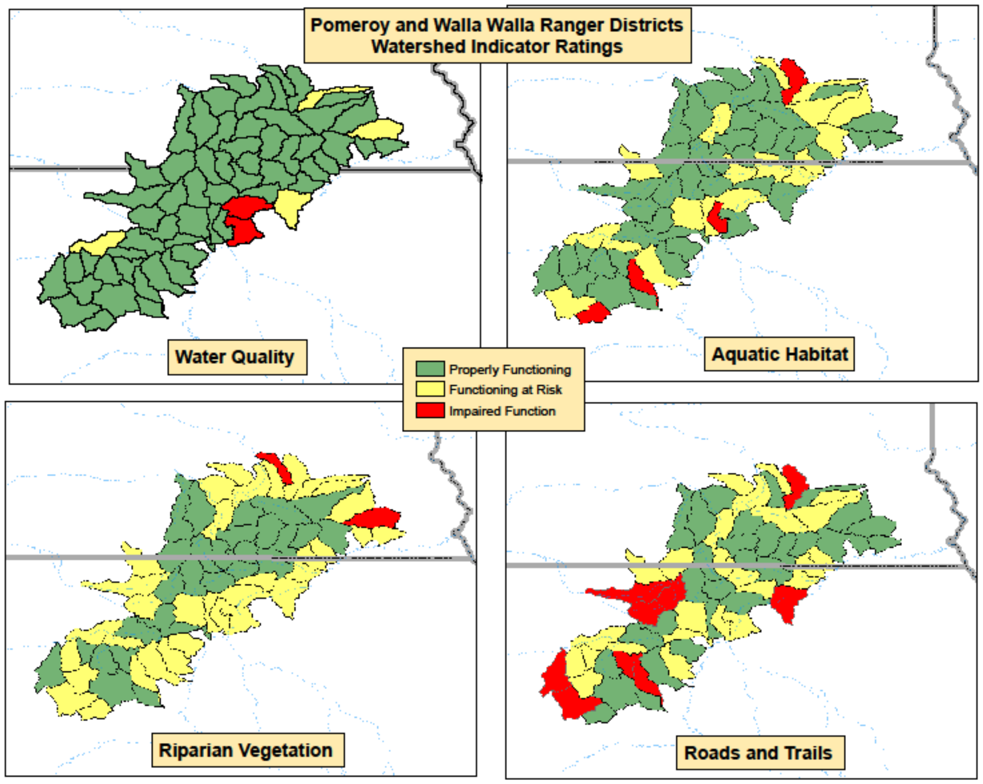
Attributes	Good (1) Functioning Properly	Fair (2) Functioning at Risk	Poor (3) Impaired
Riparian Vegetation Condition Indicator	Native vegetation is in proper functioning condition throughout the stream corridor or along wetlands and water bodies.	Disturbance partially compromises proper functioning condition of native vegetation attributes in stream corridor areas or along wetlands and water bodies.	A large percent of native vegetation attributes along stream corridors, wetlands and water bodies are not in proper functioning condition.
Vegetation Condition	Native mid to late seral vegetation appropriate to the sites potential dominates the plant communities and is vigorous, healthy and diverse in age, structure, cover and composition on >80% of the riparian/wetland areas in the watershed. Sufficient reproduction of native species appropriate to the site is occurring to ensure sustainability. Mesic herbaceous plant communities occupy most of their site potential. Vegetation is in a dynamic equilibrium appropriate to the stream or wetland system.	Native vegetation demonstrates a moderate loss of vigor, reproduction and growth, or changes in composition, especially in areas most susceptible to human impact. Areas displaying light to moderate impact to structure, reproduction, composition and cover may occupy 25 to 80% of the overall riparian area with only a few areas displaying significant impacts. Up to 25% of the species cover or composition occurs from early seral species and/or there are some localized but relatively small areas where early seral vegetation dominates, but the communities across the watershed are still dominated by mid to late seral. Xeric herbaceous communities exist where water relationships have been altered but are relatively small, localized, generally are not continuous across large areas, and do not dominate across the watershed.	Native vegetation is vigorous, healthy and diverse in age, structure, cover and composition on <75% of the riparian/wetland areas in the watershed. Native vegetation demonstrates a noticeable loss of vigor, reproduction and growth, and changes in composition as compared with the site potential communities throughout areas most susceptible to human impact. In these areas, cover and composition are strongly reflective of early seral species dominance although there will be late seral and mid seral species present, especially in pockets. Mesic dependent herbaceous vegetation is limited in extent with many lower terraces dominated by Xeric species most commonly associated with uplands. Reproduction of mid and late seral species is very limited. For much of the area, the water table is disconnected from the riparian area and the vegetation reflects this loss of available soil water

Roads and Trails

Roads and trails were rated based on factors that include open road density, maintenance investment, proximity to water, with 44 rated good, 65 fair, and 18 watersheds rated poor condition. Road management is an ongoing agency emphasis, with national direction for transportation analysis to identify a "sustainable" (economic, social, and ecological) road system, and years of investment to reduce road impacts. Ongoing challenges include desire for public access for various purposes, needs for access for resource management and protection, and diminished funding for maintenance and storage or decommissioning of unneeded roads.

Table 6: Roads and trails condition rating rule.

Attributes	Good (1) Functioning Properly	Fair (2) Functioning at Risk	Poor (3) Impaired
Road and Trail Condition Indicator	The density and distribution of roads and linear features within the watershed indicates the hydrologic regime is substantially intact and unaltered.	The density and distribution of roads and linear features within the watershed indicate there is a moderate probability that the hydrologic regime is substantially altered.	The density and distribution of roads and linear features within the watershed indicate there is a higher probability that the hydrologic regime (timing, magnitude, duration, and spatial distribution of runoff flows) is substantially altered.
Open Road Density	Default road/trail density < 1 mi/mi^2, OR a locally determined threshold for good conditions supported by Forest Plans or analysis and data.	Default road/trail density 1 - 2.4 mi/mi^2, OR a locally determined threshold for fair conditions supported by Forest Plans or analysis and data.	Default road/trail density >2.4 mi/mi^2, OR a locally determined threshold for poor conditions supported by Forest Plans or analysis and data.
Road and Trail Maintenance	BMPs for the maintenance of designed drainage features are applied to >75% of the roads, trails, and water crossings in the watershed.	BMPs for the maintenance of designed drainage features are applied to 50 to 75% of the roads, trails, and water crossings in the watershed.	BMPs for the maintenance of designed drainage features are applied to <50% of the roads, trails, and water crossings in the watershed.
Proximity to Water	No more than 10% of road/trail length is located within 300 feet of streams and water bodies or hydrologically connected to them.	10 - 25% of road/trail length is located within 300 feet of streams and water bodies or hydrologically connected to them.	More than 25% of road/trail length is located within 300 feet of streams and water bodies or hydrologically connected to them.
Mass Wasting	Very few roads are on unstable landforms or rock types subject to mass wasting with little evidence of active movement or evidence of road damage. There is no danger of large quantities of debris being delivered to the stream channel due to mass wasting.	Few roads are on unstable landforms or rock types subject to mass wasting with moderate evidence of active movement or road damage. There is some danger of large quantities of debris being delivered to the stream channel. It is not a primary concern in this watershed.	Most roads are on unstable landforms or rock types subject to mass wasting with extensive evidence of active movement or road damage. Mass wasting that could deliver large quantities of debris to the stream channel is a primary concern in this watershed.



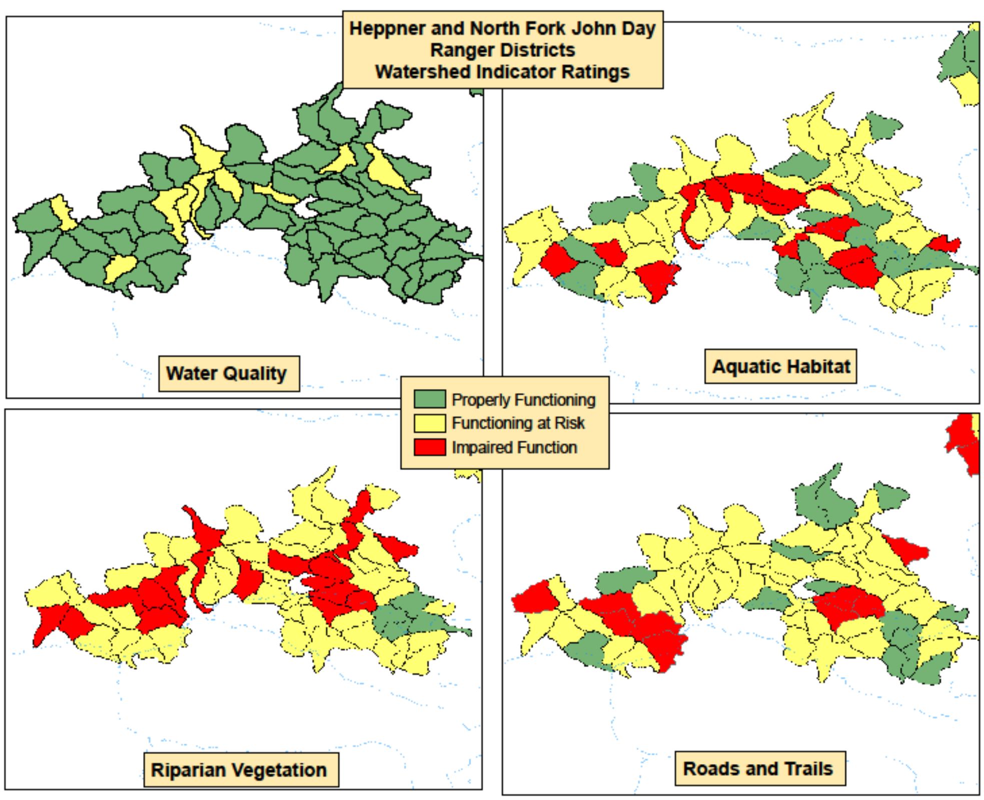


Figure 3: Watershed Condition Framework indicator ratings for the Umatilla Forest.

Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect soil and hydrologic functions supporting aquatic ecosystems. The National priority subwatersheds and regional focus watersheds have been identified on the Umatilla National Forest utilizing the Regional Aquatic Restoration Strategy (2018) and the national Watershed Condition Framework (WCF) (USDA, FS-977, 2011).

(http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf).

The 10-digit watershed scale is considered a strategic scale for analysis and long term restoration planning, whereas the 12-digit subwatershed scale is considered an operational scale for near term (3-5 year) investment in completion of essential projects.

The National Forests reviewed existing priorities and selected subwatersheds for near-term (3-5 year) focused investment, and identified "essential projects" to maintain or improve watershed conditions detailed in "Watershed Restoration Action Plans" (Table 4). Essential projects are defined as actions and treatments that are implemented as an integrated suite of on-the-ground management activities focused primarily on restoring watershed function and thereby improving watershed condition class.

Table 7: Watershed Restoration Action Plans for priority subwatersheds on Umatilla National Forest.

Priority Subwatershed (6th field HUC)	12-digit Hydrologic Unit Code	Watershed Restoration Action Plan Developed	Status
Clear Creek	170702020204	2011	On-going
Upper Big Wall Creek	170702020805	2011	On-going
Cummings Creek	170601070604	2012	On-going
Upper North Fork Touchet	170701020301	2012	Completed in 2016

Watershed Restoration Action Plans (WRAPs) are based on these process-based principles and an assumption that complete restoration of a watershed is often socially, economically, and/or politically impossible because road systems and other infrastructure will remain intact due to public demands. Therefore, the removal of all disruptions and returning an entire landscape to a natural disturbance regime is not possible for most watersheds. Consequently, WRAP projects strategically address anthropogenic disruptions that are not precluded by social, economic, and/or political constraints. As such, disruptions can be eliminated (e.g., road decommissioning) or modified (e.g., culvert replacement) to better accommodate natural processes at the reach or watershed scale.

Once WRAP actions are completed, a sub-watershed will be transformed into one that has been moved closer to a natural, reference condition. Over time, however, economic, social, and/or political constraints may go away, allowing additional projects to be implemented and moving the watershed even closer to natural, reference conditions. From there, action agencies will direct efforts to complete additional WRAPs in other priority watersheds with an ultimate objective of creating a network of restored watersheds throughout evolutionary significant units (ESU), distinct population segments (DPS), or interim recovery units (IRU). Thus, WRAPs have and continue to serve as the primary means to deliver scarce resources to priority watersheds for the restoration of fish stocks and water quality.

Fish and Aquatic Species Report and Biological Evaluation

This section evaluates aquatic species and habitat conditions and discloses the potential direct, indirect, and cumulative effects of the proposed alternatives to those species and their habitats. Specie(s) and their habitat(s) evaluated for this project are found in Table 1. Discussions regarding water quality and impacts to aquatic species and their habitats derives from analysis in the hydrology and soils reports.

Programs and activities on the Umatilla National Forest are reviewed to determine how they may affect aquatic species listed under the Endangered Species Act (ESA) and the Regional Forester's Special Status Species List (as required under the National Forest Management Act). National Forest Service policy for any ESA or Regional Forester's listed species is stated in FSM 2670 and the U.S. Department of Agriculture Regulation 9500-4.

Responsibilities are implemented through Threatened, Endangered, and Sensitive Species Programs. The primary objective is to recover federally listed and proposed species, and for Special Status/Sensitive species, to ensure that actions do not contribute to a loss of viability or cause a significant trend toward listing under the ESA. The effects of any action authorized, funded, or carried out by the Forest Service on a Federally Listed, Federally Proposed, or Special Status/Sensitive species is analyzed in a Biological Evaluation (Region Six Letter of Direction "Update of the Regional Forester's Special Status Species List" July 21, 2015 on file).

- The Fisheries and Aquatic Species Report and Biological Evaluation were prepared in accordance with the following guidance and direction:
- Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 (as amended),
- National Forest Management Act of 1976,
- Umatilla National Forest (UNF) Land and Resource Management Plan (LRMP) (1990), as amended by PACFISH (1995b),
- Magnuson-Stevens Fishery Conservation and Management Act (MSA revised 2014), and
- Regional Six Regional Forester's Special Status Species List 2015 (RFSSL)

This analysis is considered the Fisheries Biological Evaluation and Specialist Report which satisfies all requirements of a Biological Evaluation required for the Aquatic Restoration Environmental Assessment. As such, this report will address species listed under the ESA, MIS species, and RFSSL species and their habitats; and meet MSA requirements.

Federally Listed Threatened, Endangered and/or Proposed Species

The Endangered Species Act (ESA) requires federal agencies to ensure that actions authorized, funded or carried out by them are not likely to jeopardize the continued existence of listed or proposed species, or result in the destruction or adverse modification of their critical habitats (ESA Section 7). The Forest Service has established direction in Forest Service Manual 2670 to guide the management of habitat for threatened, endangered, and sensitive species. Habitats and activities for threatened and endangered species on National Forest System lands are to be managed to achieve recovery objectives such that special protections under the ESA are no longer necessary (FSM 2670.21). Detailed analyses of federally listed fish species are provided in the 2013 Aquatic Restoration Biological Assessment II (ARBA II), which is available for viewing in the project record.

Management Indicator Species

Management Indicator Species (MIS) are defined in the UNF LRMP as "A species selected because its welfare is presumed to be an indicator of the welfare of other species using the same habitat…" Habitat conditions in the forest are managed for MIS species. On the UNF the aquatic MIS are Middle Columbia River steelhead *Oncorhynchus mykiss* and the resident life history of *O. mykiss* redband trout.

Regional Forester Special Status and Sensitive Species List

A number of Regional Forester sensitive invertebrate and aquatic vertebrate species are known or suspected on the Umatilla National Forest, and their known or suspected presence across the UNF are described in Table 1. Extensive life history information for each species is found in Fact Sheets on file on the UNF.

Magnuson-Stevens Fishery Conservation and Management Act

Magnuson-Stevens Fishery Conservation and Management Act (MSA revised 2014) was established for stocks managed under a Federal Fishery Management Plan with protections for Essential Fish Habitat. On the UNF this includes Chinook salmon habitat found in the Umatilla and Tucannon River and Lookingglass Creek. Consultation and coordination under MSA for EFH is consolidated with ESA processes to avoid duplication and improve efficiency. MSA was addressed in the 2013 ARBA, which is available for viewing in the project record. Analysis will not be repeated here.

Table 8: RFSSL, ESA and MIS Aquatic Species on the UNF

Regional Forester's Special Status Sensitive Species List July 2015 (RFSSL)								
			Documented or Suspected (D or S)					
Common Name and Species	**Status**	**UMA FOREST**	**NFJD (OR)**	**HEPP (OR)**	**Walla Walla (OR)**	**Walla Walla (WA)**	**Pomeroy (WA)**	**Nearest Documented locations**
Forest wide								
Columbia Clubtail *Gomphus lynnae*	SEN	S	S	S	S	S	S	John Day River (Grant/Wheeler); Spokane BLM
Pacific Lamprey *Entosphenus tridentatus*	SEN	D	D	D	D	D	D	Multiple Locations on UNF
Inland Columbia Basin redband trout *Oncorhynchus m. gairdneri*	SEN	D	D	D	D	D	D	Multiple Locations on UNF
Oregon Only								
Western Ridge Mussel *Gonidea angulata*	OR-SEN	D	D	D	D			Uma River, Ryan, Thomas; NF/MF John Day River; Birch, Butter McKay
Shortface Lanx *Fisherola nuttalli*	OR-SEN	S			S			Grande Ronde R. in Washington 3 sites,
Westslope cutthroat trout *Oncorhynchus clarkii lewisi*	OR-SEN	D	D					Granite and Desolation Watersheds
Washington Only								
Pristine Springsnail *Pristinicola hemphilli*	WA-SEN	D				S	D	Tucannon River
Federal ESA fish listing, critical habitat and listing dates	Federal Status		Date Listed or confirmed	Critical Habitat	Recovery Plan	Ecologically Significant Unit (ESU) or Designated Population Segment (DPS)		
Steelhead *O. mykiss*	FT*	D	1999; 2006	Designated 2005	Final 2009	Middle Columbia River**		

Steelhead *O. mykiss*	FT	D	1997; 2006	Designated 2005	2016	Snake River Basin**
Chinook salmon *O. tyshawytscha*	FT	D	1992; 2005	Designated 1999	2016	Snake River Spring/ Summer runs
Chinook salmon *O. tyshawytscha*	FT	D	1992; 2005	Designated 1993	2016	Snake River Fall runs (not found on UNF but present downstream in Snake River)
Bull Trout *Salvelinus confluentus*	FT	D	1998	Designated 2010	Final 1999; Revised 2015	Columbia River

*FT Federal Threatened

** also designated **Management Indicator Species** as resident form *O. mykiss* Redband Trout

species fact sheets on file Umatilla NF Supervisors Office

Resource Indicators and Measures

This report tiers to ARBA II and ARBO II (2013). As presented in ARBA II and ARBO II, this report follows the same analysis process and evaluates effects through the Matrix of Pathways and Indicators (MPI) (NMFS 1996 and USFWS 1999). Use of the MPI allows a system approach to describe effects to water quality and fish habitat. As displayed in Table 2 Resource Elements have associated Resource Indicators, and are related water quality and aquatic habitats.

Table 9: Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Used to address P/N or key issue?	Source
Water quality	Turbidity, Temperature Chemical Contaminants	yes	Matrix of Pathways and Indicators (USFWS & NMFS)
Habitat Access	Physical Barriers	yes	Matrix of Pathways and Indicators (USFWS & NMFS)
Habitat Elements	Substrate/Sediment, Large Wood, Pool Frequency, Pool Quality, Off-Channel Habitat, Refugia	yes	Matrix of Pathways and Indicators (USFWS & NMFS)
Channel Condition and Dynamics	Width/Depth Ratio, Streambank Condition, Floodplain Connectivity	yes	Matrix of Pathways and Indicators (USFWS & NMFS)
Flow/Hydrology	Changes in Peak/Base Flows; Increase in Drainage Network	yes	Matrix of Pathways and Indicators (USFWS & NMFS)
Watershed Condition:	Road Density and Location; Riparian Reserves; Disturbance History	yes	Matrix of Pathways and Indicators (USFWS & NMFS)

Methodology

Analysis Method

- Determine distribution of ESA, RF Region 6 SSSL, and MIS aquatic species within Project Area.
- Determine potential effects to aquatic species by implementation category and associated project design criteria. The effects of the programmatic actions will be analyzed using the Matrix of Pathways and Indicators
- Determine potential effects to impaired waterbodies as defined by the 2012 Oregon DEQ 303(d) list, by implementation category and associated project design Criteria.

Information Sources

Information used for this analysis comes from:

- State Of Oregon; Department of Environmental Quality (DEQ), Oregon Department of Fish and Wildlife (ODFW)
- State of Washington; Washington Department of Fish and Wildlife
- Internal information (GIS, Surveys, Professional Judgment)
- National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS)
- USFS Region 6 restoration strategies including ARCS, WCF, ARBA II

Incomplete and Unavailable Information

A variety of information was used to describe distribution and life history of the aquatic organisms included in this analysis. ESA listed species distribution surveys are documented through stream surveys and project level surveys (on file). Distribution of other species is less well known. The analysis will tier to and rely heavily on the analysis of the Aquatic Restoration Biological Assessment and Opinion (ARBA II and ARBO II 2013) to support conclusions and lay the frame work for implementation. Currently there are no significant data gaps that would impede this analysis and or the implementation of this project.

Fisheries - Affected Environment

Species Description and Existing Condition

Distribution of anadromous fish on the Umatilla NF are described by the two major watersheds that divide the UNF; the Snake River basin (SRB) and Middle Columbia River basin (MCR). The acronyms SRB and MCR are used extensively in the following descriptions.

Steelhead

Two Distinct Population Segments (DPS) of steelhead, MCR and SRB, are found within the analysis area (Figure 1). Table 1 provides ESA listing history. See the Aquatic Restoration Biological Assessment (2013) for a description of the species life history. In 2015 NMFS published status reviews of both DPS (USDC NMFS 2015), and overall both DPS populations are stable (versus declining or improving). Recovery plans have also been completed. Table 3 summarizes steelhead distribution and their Designated Critical Habitat (DCH) in the analysis area on the UNF.

Table 10: Miles of Steelhead distribution and miles of steelhead DCH.

DPS	Habitat Miles
SRB steelhead distribution	322 miles
SRB steelhead Designated Critical Habitat	284 miles
MCR steelhead distribution	445 miles
MCR steelhead Designated Critical Habitat	647 miles

Middle Columbia River Basin Steelhead

The MCR steelhead DPS consists of three Major Population Groups (MPGs): the Umatilla, Walla Walla and John Day, all located in the Middle Columbia portion of the Columbia River Basin (Table 4). Hatchery stock produced by the Umatilla River and Touchet River hatchery programs are considered part of this DPS. Habitat concerns exist throughout the range of the MCR steelhead DPS particularly in regards to water quality, water quantity, and riparian condition.

Table 11: Middle Columbia River Steelhead Status of Major Population Groups

MPG	Population	Population Current Condition
Umatilla/Walla Walla	Umatilla	Moderate risk/ Maintained
Umatilla/Walla Walla	Walla Walla	Moderate risk/ Maintained
Umatilla/Walla Walla	Touchet	High risk
Umatilla/Walla Walla	Willow Creek	Extinct
John Day	North Fork John Day	Low-Very Low Risk/Highly viable
John Day	Lower Mainstem John Day	Moderate risk/Maintained
John Day	Middle Fork John Day	Moderate risk/Maintained

Umatilla/Walla Walla MPG

The Umatilla and Walla Walla River MPG consists of 3 extant populations geographically located in the Umatilla and Walla Walla subbasins respectively. The Walla Walla River population straddles the Oregon/Washington state boundary.

Stream temperature, altered sediment routing, degraded channel structure and seasonal low instream flows are major habitat-related limiting factors for the Umatilla/Walla Walla/Touchet MPG (NMFS 2011, NMFS 2015):

John Day River MPG

The John Day River Major Population Group occupies the John Day River drainage. The MPG contains five extant populations, three of which are represented in the analysis area: Lower Mainstem John Day, North Fork John Day and Middle Fork John Day. Steelhead in these populations are exclusively summer steelhead. The MPG is one of the few remaining summer steelhead groups in the Interior Columbia basin with minimal influence from introduced hatchery steelhead. The MPG is classified as strong or healthy. Spawning is widely distributed across tributary and mainstem habitats.

The population in the North Fork John Day River is considered “highly viable”. In comparison, the other two populations are still considered at “Moderate risk”. Major limiting factors for the John Day River MPG include degraded channel structure and complexity (habitat quantity and diversity), altered sediment routing, altered hydrology and low flows, elevated water temperatures, and impaired fish passage.

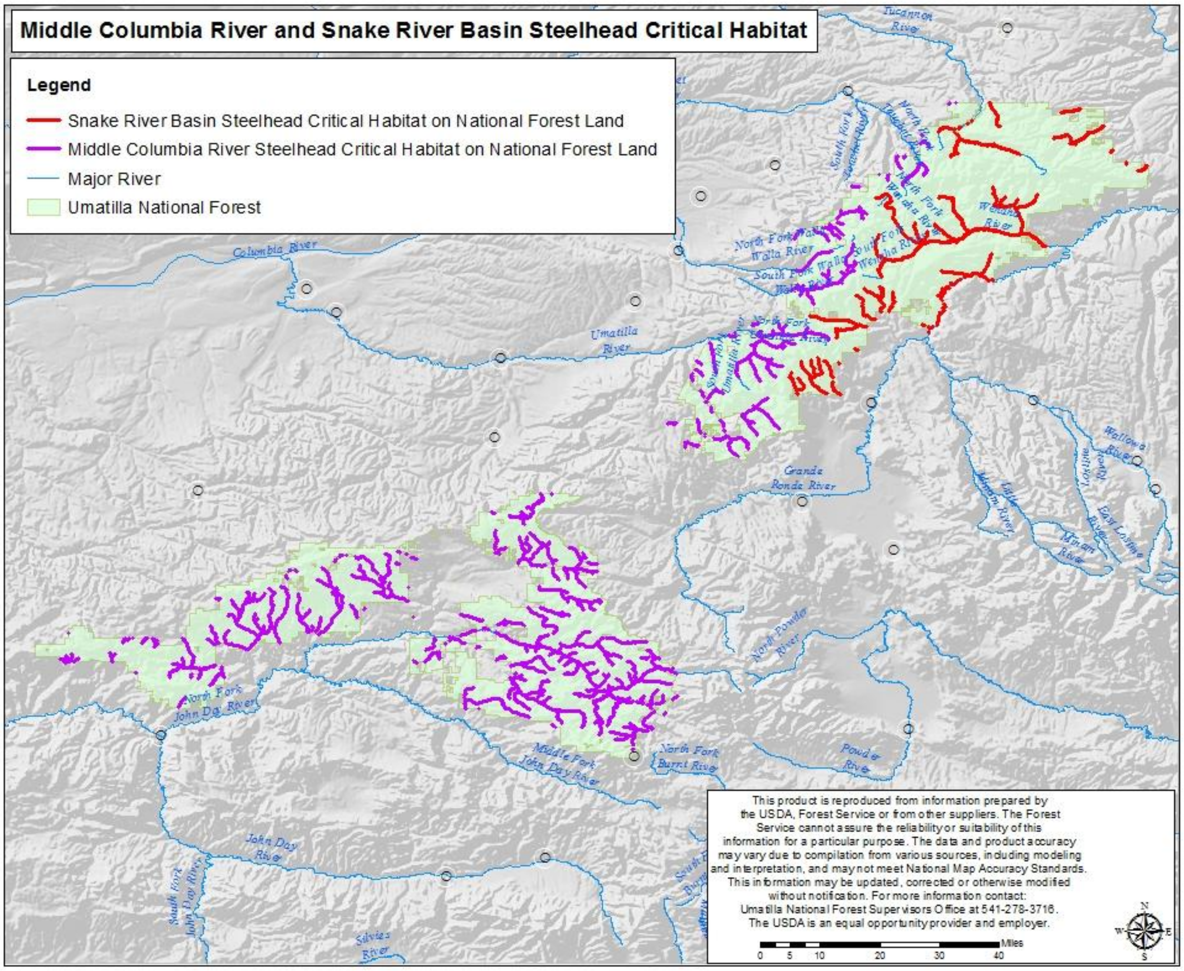


Figure 4: Mid-Columbia River and SRB steelhead critical habitat distribution on UNF.

Snake River Basin

The SRB steelhead DPS is comprised of five extant MPGs and one functionally extinct MPG. Two of the extant MPGs, Grande Ronde River and Lower Snake River, are represented in the analysis area. (Table 5).

Table 12: Snake River Basin steelhead MPG status

MPG	Population	Current Risk Status
Lower Snake	Tucannon	Maintained/High Risk
Lower Snake	Asotin	Maintained/Moderate risk
Grande Ronde	Lower Mainstem Grande Ronde	Maintained/Moderate risk
Grande Ronde	Upper Mainstem Grande Ronde	Viable (tentative)/

Lower Snake MPG

The following are major habitat-related limiting factors for SRB steelhead for the Tucannon, Asotin, Lower Mainstem and Upper Mainstem Grande Ronde populations in the Lower Snake MPG (NMFS 2015): habitat quantity (including impacts of summer low flows), habitat diversity, elevated sediment in some watersheds, barriers in some watersheds, and elevated water temperatures (may not be limiting factors in all watersheds)

Spring/Summer Chinook salmon

Spring/summer chinook salmon are listed as ESA threatened in the SRB (Table 5) and are not listed on the ESA in the MCR. Hatchery stocks are produced in subbasins in the MCR and SRB regions. Spawning and rearing habitats for chinook and steelhead overlap within UNF boundaries, although steelhead distribution is more extensive in certain watersheds (Figure 2). See the Aquatic Restoration Biological Assessment (2013) for a description of the species life history.

Table 13: ESA listed spring/summer Chinook salmon distribution of habitat.

ESU /Stocks	Habitat Miles
SRB spring/summer Chinook salmon distribution	46 miles
SRB spring/summer Chinook salmon Designated Critical Habitat	284 miles

Middle Columbia River Basin (MCR)

Spring Chinook salmon in the Umatilla basin are protected by the MSA. Habitat used by spring Chinook salmon consists of main rivers and major tributaries These Chinook salmon populations are not listed under the Endangered Species Act.

Snake River Basin (SRB)

The SRB spring/summer Chinook salmon ESU is comprised of five Major Population Groups (MPG), two of which are represented in the analysis area: Lower Snake River and Grande Ronde/Imnaha (NMFS 2015). Risk status is presented in Table 6.

Table 14: Population's viability as of 2016 for SRB spring/summer chinook.

MPG	Subbasin	Population	Current Risk Status
Lower Snake	Tucannon	Tucannon	High Risk
Grande Ronde/Imnaha	Lower Main Grande Ronde	Wenaha	High Risk
Grande Ronde/Imnaha	Upper Grande Ronde	Upper Mainstem Grande Ronde	High Risk
Grande Ronde/Imnaha	Upper Grande Ronde	Lookingglass	Functionally extirpated

Lower Snake River and Grande Ronde/Imnaha MPG

The Tucannon River population and the Grande Ronde MPG are represented in the analysis area by two extant populations: the Wenaha in the Lower Grande Ronde subbasin, and the Upper Mainstem Grande Ronde population, along with a functionally extirpated population in the Lookingglass watershed.

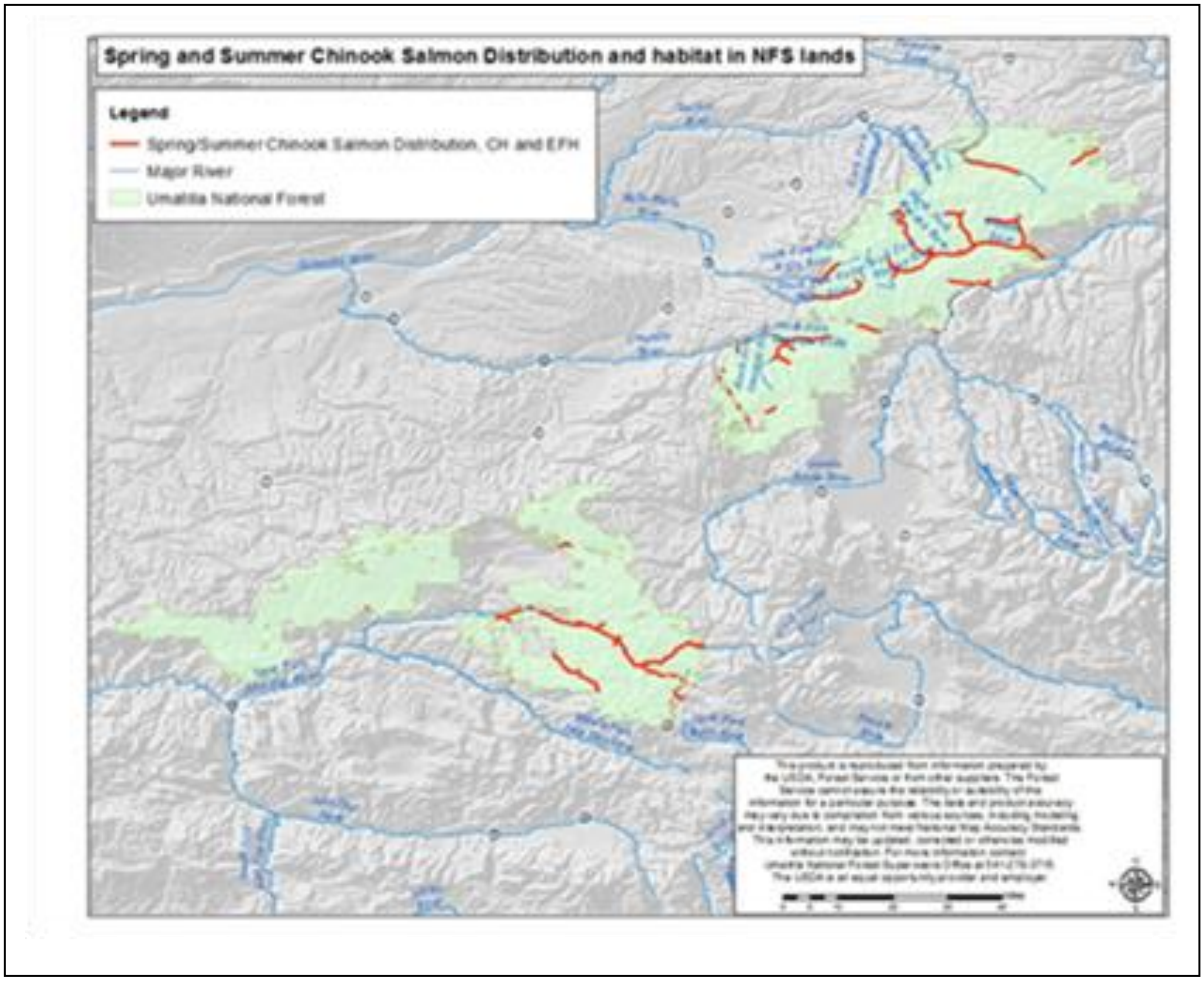


Figure 5: Chinook salmon distribution and habitat on the Umatilla National Forest.

Managers of the Chinook salmon hatchery at the mouth of Lookingglass Creek, a major tributary to the Grande Ronde River, began allowing excess returning adult hatchery salmon to pass the hatchery diversion weir upstream into the upper watershed in recent years, allowing for limited amounts of natural reproduction in the drainage.

Major habitat-related limiting factors for SRB spring/summer Chinook salmon in the Lower Snake MPG (NMFS 2015) and Grande-Ronde/Imnaha include loss of riparian trees, confinement of the floodplain and lack of channel meander, excessive fine sediments, reduced stream flows; lack of habitat quality and diversity and high summer water temperatures.

Fall Chinook salmon

Critical Habitat has been designated for fall chinook salmon and is found adjacent and downstream of the Umatilla NF. Fall chinook CH is entirely encompassed by spring and summer chinook CH. For document readability, effects discussion to spring/summer chinook CH also applies to fall chinook CH.

Bull trout

Information on Bull trout ESA listing by the USFWS as threatened is found in Table 1. See the Aquatic Restoration Biological Assessment (2013) for additional bull trout life history.

Bull trout populations in the analysis area are found in Mid-Columbia Recovery Unit (USFWS 2015). Six Recovery Unit core areas lie within or partially within the Umatilla National Forest. Those core areas are predominantly defined by subbasin boundaries (Table 7). The Recovery Plan describes the number of local spawning and rearing populations by core area, displayed in Table 7.

Designated critical habitat for Columbia River Bull trout on and adjacent to the Umatilla National Forest (Figure 4), consists of spawning and rearing tributaries, as well as main rivers used for foraging, migration and overwintering (FMO) habitat. On the UNF FMO habitat are relatively large streams and mainstem rivers where subadult and adult migratory bull trout forage, migrate, mature, or overwinter. This habitat is typically downstream from bull trout spawning and rearing habitat.

Some segments of FMO habitat may be used by bull trout from one or more core areas. The Mid-Columbia Recovery Unit contains seven segments of shared FMO habitats in the John Day and Grande Ronde rivers. Many streams on the UNF provide the cool, clean water need for bull trout juvenile rearing (Figure 3).

Table 15: Bull trout distribution and habitat on the Umatilla National Forest

<table>
<tr><th>Recovery Unit</th><th>Subbasin</th><th>Core Area</th><th>Number of local Populations</th><th>Spawning and rearing (UNF miles)</th></tr>
<tr><td rowspan="4">Lower Mid-Columbia</td><td>North Fork John Day</td><td>North Fork John Day River</td><td>7</td><td>42</td></tr>
<tr><td>Umatilla</td><td>Umatilla River</td><td>1</td><td>8</td></tr>
<tr><td rowspan="2">Walla Walla</td><td>Walla Walla River</td><td>3</td><td>37</td></tr>
<tr><td>Touchet River</td><td>3</td><td>18</td></tr>
<tr><td rowspan="4">Lower Snake</td><td>Tucannon</td><td>Tucannon River</td><td>5</td><td>27</td></tr>
<tr><td>Asotin</td><td>Asotin Creek</td><td>1</td><td>8</td></tr>
<tr><td>Upper Grande Ronde</td><td rowspan="2">Lookingglass/Wenaha</td><td rowspan="2">4</td><td rowspan="2">57</td></tr>
<tr><td>Lower Grande Ronde</td></tr>
<tr><td>Middle Columbia Recovery Unit</td><td>UNF subbasins only</td><td>UNF core areas only</td><td>24</td><td>147</td></tr>
</table>

Declines in bull trout distribution and abundance are the results of combined effects of the following: habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion structure or other device) into diversion channels and dams, and introduced nonnative species. Some threats to bull trout are the continuing effects of past land management activities.

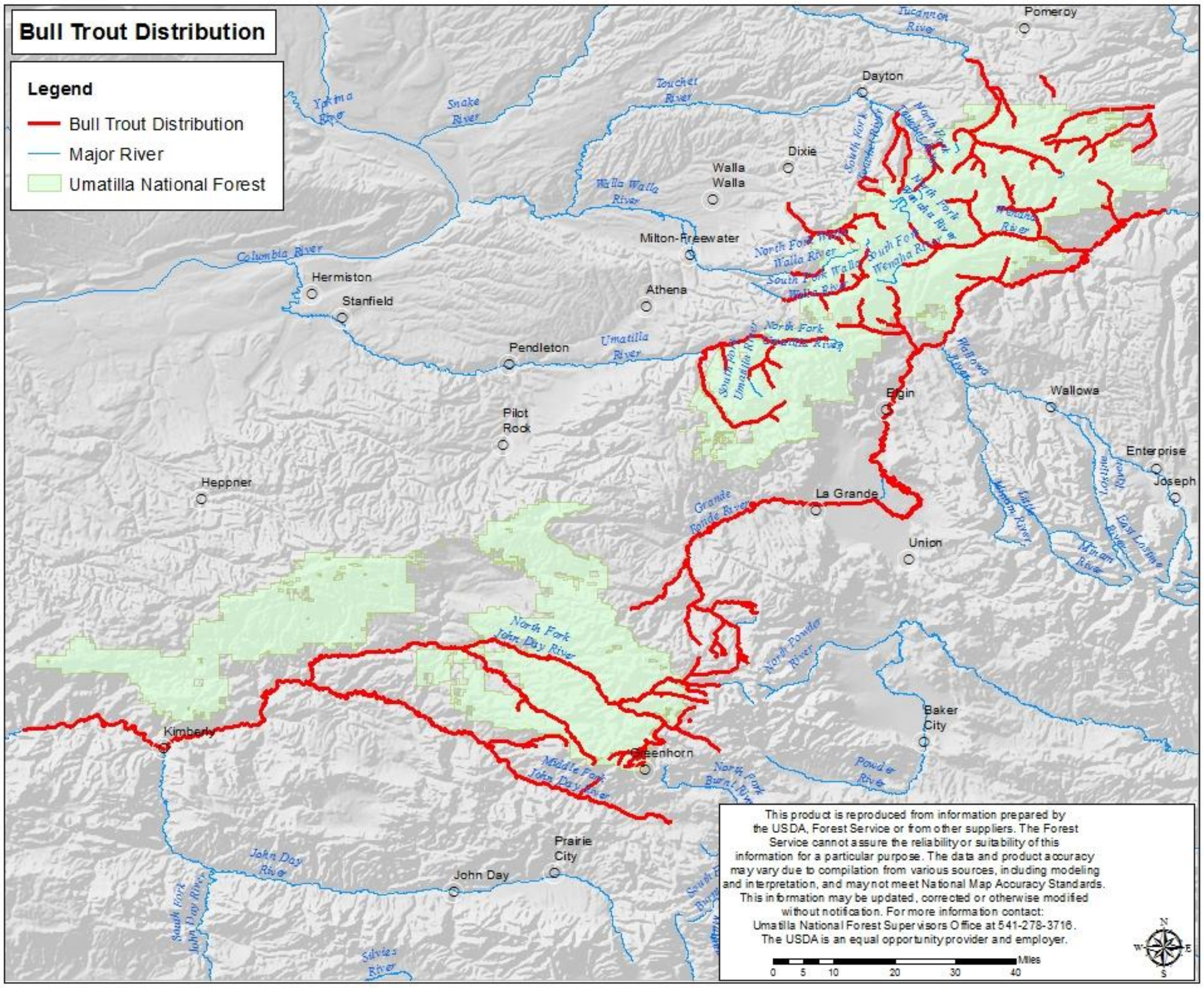


Figure 6: Columbia River bull trout distribution and DCH in and adjacent to the Umatilla National Forest. DCH overlaps with bull trout distribution.

Redband trout

Redband trout are currently on the Region 6 USFS sensitive species list, and are also considered a MIS species on the Umatilla National Forest. Redband are a resident form of steelhead trout, and exhibits habitat preferences similar to those for steelhead. Redband trout may migrate within river systems, but do not migrate to the ocean. Redband populations are often found above barriers to steelhead migration (Figure 4).

Redband trout populations are widely distributed in streams within the Umatilla National Forest. Because steelhead and redband trout are the same species expressing two different life histories, redband trout are presumed present in smaller numbers wherever adult steelhead occupy habitat. Redband are known to extend their distributions upstream into small, colder headwater tributaries at higher elevations or barriers to adult steelhead (Carmichael 2007).

Regional Forester's Special Status Species[2]

Westslope cutthroat trout

Westslope cutthroat trout are on the Region 6 Regional Forester special status sensitive species list (USDA FS 2015). They have a relatively localized distribution within the analysis in the North Fork John Day River.

Westslope cutthroat trout are found in small mountain streams, main rivers, and large natural lakes. Westslope cutthroat trout requires cool, clean, well-oxygenated water. In rivers, adults prefer large pools and slow velocity areas and often occurs near shore in lakes. Juveniles of migratory populations may spend 1-4 years in their natal streams, then move (usually in spring or early summer, and/or in fall in some systems) to a main river or lake where they remain until they spawn. Many fry disperse downstream after emergence. Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Westslope cutthroat habitat is characterized as a zone of habitat with qualities intermediate between the steelhead and bull trout habitat preferences described above. That intermediate habitat zone is available and used by westslope cutthroat and steelhead-cutthroat hybrids in the upper North Fork John Day River and a handful of high-elevation tributaries in the Granite Creek and Desolation Creek watersheds.

Pacific lamprey

Lampreys belong to a primitive group of fishes, eel-like in form and without the jaws and paired fins of true fishes. Pacfic lamprey spawn in habitat similar to salmon, in gravel bottom streams above the habitat suitable for young larvae (ammocoetes). Pacific lamprey may live 2 – 7 years in fine substrates where they burrow and filter feed before emigration to the ocean. Pacific lamprey are widely distributed and documented in numerous locations across the UNF (USFWS fact sheet on file).

Shortface Lanx

Fisherola nuttalli is a small pulmonate (lunged) snail in the family Lymnaeidae. It inhabits cold, unpolluted, medium to large streams with fast-flowing, well-oxygenated water and cobble/boulder substrate, and is generally found at the edges of rapids. It was historically present throughout much of the Columbia River drainage in Washington, Montana, Oregon, Idaho, and British Columbia, but most populations were extirpated due to habitat loss resulting from dams, impoundments, water removal, and pollution. Currently, large populations of *F. nuttalli* persist in only four streams: the lower Deschutes River in Oregon; the Okanogan River and the Hanford Reach of the Columbia River in Washington; and the Snake River in Oregon and Idaho. Shortface lanx have not been documented on the UNF, but are suspected to, or could occur within the analysis boundary and are therefore considered in this analysis.

Columbia clubtail

The Columbia clubtail is a member of the Anisoptera sub-order, which includes all North American dragonflies. Nymphs will burrow into the silt or mud, leaving only their head and tail-end exposed. The streams that provide suitable habitat for Columbia clubtail are threatened by continued water drainage and diversion for irrigation and development purposes, as well as stormwater run-off containing pesticides. Oregon sightings of Columbia clubtail include locations along the John Day River. Columbia clubtail have not been documented on the UNF, but are suspected to, or could occur within the analysis boundary and are therefore considered in this analysis.

[2] Unless noted otherwise, species discussed have species fact sheets on file Umatilla NF Supervisors Office Pendleton OR

Western ridged mussel

The western ridged mussel (*Gonidea angulata*) is widely distributed from southern British Columbia to southern California, and can be found east to Idaho and Nevada. *G. angulata* inhabits cold creeks and streams from low to mid-elevations. Little is known about the fish species that serve as hosts for this mussel throughout other parts of its range. *Gonidea. angulata* is sedentary as an adult and probably lives for 20-30 years, and thus can be an important indicator of habitat quality. *G. angulata* is a filter feeder that consumes plankton and other suspended solids, nutrients and contaminants from the water column. Western ridged mussels have been documented in the Middle Fork and North Fork John Day River drainages, the Umatilla River drainage and the Walla Walla River drainage.

Pristine Springsnail

Habitats supporting this snail tend to be small cold springs or seeps which are in a pristine condition and contain coarse gravel/cobble substrate, or in larger springs or areas of small streams which are affected by springs. Plants commonly found in association with the species include *Rorippa, Mimulus* and bryophytes. Sites tend to occur at low-medium elevation and are in semiarid sage scrub. Colonies are scattered through the Colombia and Snake River basins into western Idaho.

Note: Conclusions from the analysis for fishes will be used to qualitatively estimate effects for invertebrates since the aquatic species utilize the same habitat, and detailed distribution and habitat requirements are not well known for the invertebrates.

UNF MPI Watershed Summary Ratings

The MPI used to assess conditions at a watershed scale. For the Aquatic Restoration EA the MPI was used to evaluate an aggregated summary of baseline conditions for subbasins within the Umatilla National Forest and is presented in Table 16 (original table from draft Blue Mt. Forest Plan Revision 2017, copy on file at Umatilla NF Pendleton, OR). The MPI crosswalks with the WCF; the WCF categories of "properly functioning", "functioning-at-risk", or "impaired function" descriptions are equivalent to "functioning appropriately", "functioning-at-risk" and "functioning at unacceptable risk" categories MPI. Ratings are for non-wilderness portions of these subbasins only. The wilderness portions are all considered to be functioning appropriately.

Table 16: Summary of Baseline Conditions for all Subbasins within the Umatilla NF.

Subbasin	Pathway						
4th level HUC and Name	Water quality	Habitat Access	Channel conditions and dynamics	Flow/ Hydrology	Integration of species and habitat conditions	Population Characteristics (for bull trout only)	Watershed conditions
17060103 Lower Snake-Asotin	FR	FR	FR	FR	FR	FUR	FR
17060106 Lower Grande Ronde	FR	FUR	FR	FR	FR	FUR	FR
17060107 Lower Snake-Tucannon	FR	FR	FR	FR	FR	FR	FR

Subbasin	Pathway						
4th level HUC and Name	Water quality	Habitat Access	Channel conditions and dynamics	Flow/ Hydrology	Integration of species and habitat conditions	Population Characteristics (for bull trout only)	Watershed conditions
17070102 Walla Walla	FA	FR	FR	FA	FR	FR	FR
17070103 Umatilla	FUR	FR	FUR	FUR	FUR	FUR	FUR
17070202 North Fork John Day	FR	FR	FR	FA	FR	FA	FR
17070203 Middle Fork John Day	FUR	FUR	FR	FUR	FUR	FUR	FR

FR = functioning at risk
FA = functioning appropriately
FUR = functioning at an unacceptable risk

Environmental Consequences

Alternative 1 – No Action

Alternative 1 - Direct and Indirect Effects

The no-action alternative is required by NEPA (36 CFR 220) to provide a baseline for comparison of effects of action alternatives. If no action were selected for this project, federal and non-federal actions are likely to continue affecting water quality, water quantity and listed fish habitat and individual aquatic species. Existing watershed degradation and associated loss of habitat would continue to maintain degraded baseline conditions that would continue to stress fish populations in most subbasins.
This alternative would continue current management, which includes a mix of protection strategies and ongoing watershed and vegetation management. Watershed and aquatic restoration would proceed at current levels, though watershed restoration is not the primary focus of forest plan direction as amended by PACFISH and INFISH.

Current management direction includes forest and regional strategies for watershed protection and passive restoration. The emphasis on watershed protection and restoration would be less than it would be for the action alternative. Under the No Action alternative, watershed conditions would be maintained or improved at current rates; however, at slower rates (fewer watersheds in improving condition) compared to the action alternative and its accelerated restoration levels (amount and intensity of projects would be more). Furthermore, not only would the Forest continue to implement a small aquatic restoration program, but would miss out on opportunities for the Aquatic Restoration Program to be integrated into the Forest's upland restoration. The Forest would also not be prepared to take advantage of many of the funding opportunities currently available to implement essential watershed restoration projects that would aid in the recovery of TES species and habitat and put watersheds back on an improving trajectory.

The level of risk associated with watershed conditions, species and habitats would be higher with this alternative since the amount and intensity of aquatic restoration would be less. Furthermore, bull trout would also be at a higher risk of extirpation (climate change, low viability, degraded baseline conditions, threats from brook trout hybridization and competitions) as it is assumed that less aquatic restoration would occur with the no action alternative. Similar impacts would affect other ESA listed species including steelhead. Some examples are below and there would be similar outcomes by not implementing other restoration categories.

Not implementing any management activities addressed in the proposed action including non-commercial thinning in conjunction with juniper removal and prescribed burning, the current conditions within these subwatersheds could potentially degrade. This is due to increasing high canopy densities; juniper encroachment; and lack of fire, which results in decreased shrub and grass density decreasing soil cover and infiltration rates. Because of decreased soil cover and infiltration rates, increased overland flow and soil erosion often occur. Therefore, there is a potential loss of water available for stream flow during dry summer months due to unusually high amounts of water that are lost to overland flow and/or evapotranspiration due to high canopy densities and encroaching juniper. If current conditions degrade in reference to uplands, then habitat for aquatic species could also degrade, not meeting the need of protection and improvement of aquatic and terrestrial habitat. Furthermore, by perpetuating unusually high stand densities the probability for catastrophic fire increases. A catastrophic fire has the potential to decimate aquatic resources by leaving no shade adjacent to the streams (increased stream temps), and denuding subwatersheds of vegetation thereby leaving exposed soils (increased sediment in streams).

By not decommissioning closed roads, the drainage network of a stream significantly increases. Roads directly affect the channel morphology of streams by accelerating erosion and sediment delivery and by increasing the magnitude of peak flow. Indirectly, if current conditions degrade then habitat for aquatic species will also degrade. The more roads and stream crossings there are, the higher the probability of sediments delivery to streams, negatively affecting the hydrologic function. In addition, roads affect the hydrograph and drainage density, increasing peak flows and decreasing low flows. This alternative does not meet the need for protection and improvement of aquatic habitat.

By not implementing any management activities addressed in the proposed action there is potential for the current conditions to degrade. Riparian vegetation, bank stability and therefore stream type could degrade because of high tree and road densities. Riparian vegetation would reflect conditions that are suited towards a dryer climate such as grasses and sage. Grass and sage species have less root mass than riparian species and therefore do not have the ability to stabilize the incised streambanks.

Consequently, Alternative 1 would have short and long term moderately negative impacts to the aquatic habitat and aquatic species. Impacts would vary by subwatershed, and be of greater magnitude in those with multiple low function indicators, or where past actions and catastrophic fire have occurred. If current conditions degrade, then habitat for aquatic species will also degrade.

Alternative 1 - Cumulative Effects

By selecting the Alternative 1 there is a potential to have long-term negative impacts to aquatic resources in comparison to the action alternative. (See Alternative 1 Direct and Indirect) However, there are no significant direct or indirect effects expected. Overall, the Umatilla will continue to be managed under the Forest Plan as amended by PACFISH, which will include some aquatic restoration management and protection. The No Action, in combination with ongoing management actions under the plan, will have slight positive cumulative impacts to Watershed and Fisheries resource indicators.

Alternative 2 – Proposed Action

The Umatilla National Forest proposes aquatic restoration on national forest system lands and on private lands, within and adjacent to the Umatilla National Forest, where we have cooperating landowners and where these restoration activities would aid in the recovery of aquatic species and impaired water bodies. (See EA for complete alternative description)

Alternative 2 - Direct and Indirect Effects

The majority of the effects and indicator descriptions that follow were taken directly from the Aquatic Restoration Biological Assessment (ARBA II). The effects of restoration activities are described in context of the Matrix of Pathways and Indicators (MPI) developed by FWS (1999) and NOAA Fisheries (1996).

This alternative would allow acceleration of aquatic restoration across the forest. It would also facilitate increased integration with the Forest's upland restoration program. The Forest would also be better prepared to take advantage of many of the funding opportunities currently available to implement essential watershed restoration projects that would aid in the recovery of TES species and habitat and put watersheds back on an improving trajectory.

Each of the aquatic restoration categories listed within the proposed action may have varying degrees of direct and indirect effects to aquatic Endangered Species Act-listed species and their critical habitat and essential fish habitat as well as to Forest sensitive and management indicator species. Direct effects cause an immediate impact. Indirect effects are those effects that occur later in time. Effects of most concern under this analysis are those resulting from short-term habitat removal or degradation or impacts that cause changes to species' growth, reproduction, and survival. The aquatic conservation measures and project design criteria are intended to minimize potential adverse direct and indirect project effects to Endangered Species Act/Magnuson-Stevens Act listed species, critical habitat, and essential fish habitat, sensitive species and management indicator species. Each action will be carefully designed and constrained by comprehensive design criteria and BMPs such that the proposed activities will have short-term, localized minor effects. In the long-term these actions will contributed to a lessening of many of the factors limiting the recovery of these species, particularly those factors related to fish passage, degraded floodplain connectivity, reduced aquatic habit complexity, and riparian conditions, and improve the currently degraded environmental baseline, particularly at the site scale (ARBO II).

Effects of the Proposed Action on the Resource Indicators

The following discussion presents the effects of the proposed activities on individual indicators. All of these actions may result in some degree of short-term adverse effects to fish or their habitat.

1. **Water Quality Pathway**
   a. **Indicator Description –** The description of the following three pathway indicators provides the ways in which they serve as essential ecological functions necessary for the overall viability of fish stocks: Water Temperature, Sediment/Turbidity, and Chemical Contamination/Nutrients.
      i. **Water Temperature –** Water temperatures affect the survival and production of fish throughout all life stages. For instance, a study of Chinook salmon survival from fertilization to hatching demonstrated that those eggs incubated at 15.0˚C had a 23% survival rate while those incubated at 9.9 and 11.4˚C had a 49 and 50% survival rate, respectively (Garling and Masterson 1985). In Chum salmon, embryo survival was demonstrated to be highest at 11˚C (Murry and McPhail 1988), hatching success of rainbow trout reaches its maximum at 10-12˚C (McCullough 1999), and preferred temperatures for bull trout ranges are 2-4˚C (McPhail and Murray 1979). Next, changing

water temperatures affect juvenile fish. Cairns et al. (2005) documented that increased temperatures in an Oregon stream resulted in higher neacus-type trematode infestations of juvenile salmonids. Further, juvenile (fry, fingerling, parr) Chinook demonstrate optimum growth between 10.0-15.6˚C (Armour 1990), while growth drastically declines or ceases at 19.1˚C (Armour 1990) and is accompanied by decreased feeding, increased stress, and warm water diseases. Juvenile bull trout are usually found in water temperatures below 12˚C (Goetz 1994). Finally, at a certain point, temperatures become lethal for all fish. McCullough (1999), citing numerous studies, stated that temperatures above 21˚C equal or exceed incipient lethal temperatures for Columbia River Chinook stocks and steelhead stocks migrating during the summer season. The best bull trout habitat in Oregon streams seldom exceeded 15˚C (Buckman et al. 1992; Ratliff 1992; Ziller 1992). Modoc suckers are typically found in streams with relatively cool (59-72° F) summer temperatures (Moyle 2002), and the Warner sucker spawns most frequently when stream temperatures range between 14-20˚C (USDI 1998c).

ii. **Turbidity –** Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival and developing alevins (Everest et al. 1987; Hicks et al. 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961; Loyd et al. 1987) due to reductions in photosynthesis within murky waters. Social (Berg and Northcoate 1985) and feeding behavior (Noggle 1978) can be disrupted by increased levels of suspended sediment. Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Kelsey et al. 1981; Megahan 1982). Robichaud et al. (2010) documented that sediment influxes into streams, which create turbidity, were lower in natural (undisturbed) forests relative to disturbed sites created by land management activities. Reeves et al. (1995) describe that sediment influxes and resulting turbidity occurs through naturally occurring landslides in western Oregon.

iii. **Chemical Contamination/Nutrients –** Aquatic ecosystem perturbations related to chemical contamination include thermal pollution, toxicity due to organic compounds and heavy metals, organic wastes and resulting changes in dissolved oxygen, acidification, and increased eutrophication. Sources of these chemical inputs commonly result from industry, urban development and agriculture. It is clear from the growing body of literature that salmon may influence the food webs, trophic structure, nutrient budgets, and possibly the productivity of freshwater and terrestrial systems, although the effect varies widely between systems and is contingent upon timing, scale, retention mechanisms, alternative nutrient sources, and baseline limiting factors (Gende et al. 2002). Reduced inputs of salmon-derived organic matter and nutrients (SDN) may limit freshwater production and thus establish a negative feedback loop affecting future generations of fish. Restoration efforts use the rationale of declining SDN to justify artificial nutrient additions, with the goal of reversing salmon decline. Biological responses to this method have also been documented (Roni et al. 2002). Elevated primary production and density of invertebrates have been associated with carcass additions (Wipfli et al. 1999). Kohler et al. (2012) documented that invertebrate productivity and fish growth increased after a carcass analog treatments in several Columbia River Basin streams. While evidence suggests that fish and wildlife may benefit from increases in food availability as a result of carcass additions, stream ecosystems vary in their ability to use nutrients to benefit salmon. Moreover, the practice may introduce excess nutrients, disease, and toxic substances to streams that may already exceed proposed water quality standards (Compton 2006).

b. Long-term Benefits of the Proposed Action to the Water Quality Pathway – The ARBA II Team (BLM, FS, BIA, FWS, NMFS) determined that numerous ARBA II activity categories will provide immediate and long-term benefits to Water Quality conditions: Large Wood, Boulder, and Gravel Placement; Dam, Tidegate, and Legacy Structure Removal; Channel Reconstruction/Relocation; Off- and Side-Channel Habitat Restoration; Streambank Restoration; Set-back or Removal of Existing Berms, Dikes, and Levees; Reduction/Relocation of Recreation Impacts; Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering; Piling and other Structure Removal; Road and Trail Erosion Control and Decommissioning. Other ARBA II activity categories may not provide immediate benefits but will provide long-term benefits to Water Quality conditions: Juniper Removal; Riparian Vegetation Treatment (controlled burning); Riparian Vegetative Planting; Beaver Habitat Restoration.

In general, the aquatic restoration categories listed above will improve or restore one or more of the following: stream structure/complexity, stream sinuosity and length, bank stability, floodplain connectivity, and riparian vegetation structure and diversity. Such results will promote conditions that maintain or decrease stream temperature (via increased shading and hyporheic flow), reduce turbidity (via stable banks, improved sediment retention through increased channel structure, riparian areas, and floodplains), and improved nutrient input (via increased riparian allocthonous sources) and retention (via increased channel structure, sinuosity, and floodplain areas).

Short-term Negative Impacts of the proposed activities to the Water Quality Pathway – As described above, ARBA II activity categories are expected to benefit the Water Quality Pathway. In acquiring these benefits, short-term negative impacts are expected. Such effects will be minimized by incorporating Aquatic Conservation Measures (ACM) and Project Design Criteria (PDC) described above and can also be found in the Aquatic Restoration Biological Assessment II (ARBA II) in Chapter II; project design, implementation, and monitoring.

The ARBA II Team determined that all activity categories (except Fisheries and Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration categories) are known to increase short-term sediment loads into a stream channel during project implementation. Increased sediment loads would result from the use of large equipment within or near a stream channel and soil exposure through controlled burning, causing soil disturbance and transport within the stream system. The ARBA II Team also concluded that these activities are unlikely to have negative impacts to stream temperatures because only minimal amounts of vegetation will be removed. For instance, Riparian and Upland Juniper Treatment (non-commercial), and Riparian Vegetation Treatment (controlled burning) will result in reduced shade on a limited basis and in such a manner as to have discountable impacts to water temperature; these impacts will be ameliorated through growth of desired riparian vegetation. Further, the ARBA II team determined that the General Aquatic Conservation Measures will minimize or prevent chemical contamination to action area waters. Therefore the following analysis will focus on activity impacts to the Turbidity Indicator.

Short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, and other projects that occur inside the bankfull channel. Other sources of sediment will arise from disturbed and exposed ground adjacent to stream channels created by heavy equipment use and moderate-severity controlled burns. The sediment plume will be most concentrated in the immediate project vicinity and should dissipate within a few hours. The amount, extent, and duration of fine sediment inputs and turbidity are related to the following: type and duration of heavy machinery used in or near a bankfull channel; soil type; the amount of soil disturbance; the sensitivity of the channel banks to erosion and other disturbances; the amount of time it takes for disturbed areas to re-vegetate and stabilize; and the probability of precipitation events before disturbed areas are re-vegetated or stabilized.

The increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish to move downstream, and alter fish behavior patterns for a short time. Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the project should not interfere with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and spawning gravels are not expected.

2. Habitat Access Pathway

a. Indicator Description – The description of the following pathway indicator provides the ways in which it serves as an essential ecological function necessary for the overall viability of fish stocks: Physical Barrier.

i. **Physical Barriers –** Human constructed physical barriers within the stream channel, such as culverts, headcuts, irrigation weirs, and dams can impair sediment and debris transport, migration routes, life history patterns, and population viability. First and second order streams, which generally include permanently flowing non-fish bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest (Benda et al. 1992). These streams are the sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms (Swanson et al. 1982; Benda and Zhanag 1990). Decoupling the stream network (through physical barriers) can result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat. Further, physical barriers prevent the movement of fish in their fulfillment of life history functions. Culverts, for instance, prevent juvenile fish from reaching rearing habitats (Furniss et al. 1991) and have blocked significant amounts of historical anadromous salmonid habitat (Roni et al. 2002; Sheer and Steel 2006). Even more, barriers restrict the expression of various life history forms within a species. Migratory movements of fluvial or adfluvial forms of bull trout, for example, can be restricted or prevented, and such a loss of life history forms restricts the full potential of fish production. Finally, strong populations rely on unimpeded access between watershed reserves, those areas of high quality habitat occupied by viable subpopulations, for dispersion and genetic interchange (Noss et al. 1997).

b. **Long-term Benefits of ARBA II Activities to the Habitat Access Pathway –** Two ARBA II activity categories, both of which contain subcategories, will restore fish passage into previously occupied habitat for all life stages of native fish. The Fish Passage Restoration category contains four sub-categories: Fish Passage Culvert and Bridge Projects; Headcut Stabilization and Associated Fish Passage; Fish Ladders; Irrigation Diversion Replacement/Relocation & Screen Installation/Replacement. The Dam, Tidegate, and Legacy Structure Removal category contains two subcategories that will target fish passage restoration: Dam and Tidegate removal. The resulting benefits include uninhibited stream access for migrating and rearing fish, restored or improved continuous paths for wood, nutrients, sediments, and other vegetative material essential for quality fish habitat.

Short-term Negative Impacts of ARBA II Activities to the Habitat Access Pathway – As described above, ARBA II activity categories are expected to benefit Habitat Access. In acquiring this benefit, short-term negative impacts are expected. Such effects will be minimized by incorporating Aquatic Conservation Measures (ACM) and Project Design Criteria (PDC) described above and can also be found in the Aquatic Restoration Biological Assessment II (ARBA II) in Chapter II; project design, implementation, and monitoring.

The ARBA II Team determined that the aforementioned activities described above may temporarily restrict habitat access during project implementation. Coffer dams and water bypass systems associated with these activities may temporarily block (few weeks) fish movement up and/or downstream through the construction area. Up and downstream fish movement will be permitted with ditch bypass systems, downstream fish movement is provided with plastic-culvert bypass structures, and no fish movement is provided with pump bypass systems. Because road crossings, dams, irrigation diversions, tidegates, and headcuts to be repaired serve as existing fish-passage barriers, coffer dams and diversion structures may not be any more of a barrier than the pre-restoration baseline. The remaining activity types are not expected to result in barriers to fish movement during any life stages and will therefore have no negative impacts to this indicator.

3. **Habitat Elements Pathway**
   a. **Indicator Description –** Descriptions of the following five indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks: Substrate/Sediment; Large Wood; Pool Frequency and Quality; Off-channel Habitat; Refugia.
      i. **Substrate/Sediment** (excerpts from Rieman and McIntyre 1993) – This indicator is similar to “Sediment” in that it addresses fines and their effects on fish habitat. Unlike “Sediment,” which addresses spawning and incubation, the substrate indicator assesses fines and their effects on rearing habitat within channel substrate. The NMFS (1996) notes that rearing capacity of salmon habitat decreases as cobble embeddedness levels increase, resulting from increased sedimentation. Furthermore, over wintering rearing habitat within substrate may be a limiting factor to fish production and survival, and the loss of this over wintering habitat may result in increased levels of mortality during rearing life stages. Likewise, when the percent of fine sediments in the substrate was relatively high, rearing bull trout were also less abundant.

      ii. **Large Wood (LW) –** Large wood in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978; Bisson et al. 1987). Common sources of large wood include falling of dead trees, wind-throw and breakage, and landslides (Johnston et al. 2011). Latterell and Naiman (2007) observed that the primary source of in-stream wood on the Queets River in Washington was from channel meandering and bank erosion through riparian areas. Large wood influences channel gradient by creating step pools and dissipating energy (Heede 1985), lengthens streams by increasing sinuosity (Swanston 1991), and serves as an important agent in pool formation (Montgomery et al.1995; Reeves et al. 2011). In low order streams, in particular, LW collects sediment and larger substrates during high flow events (Keller et al. 1985) and can account for 50% of the sediment/substrate storage sites (Megahan 1982). Further, LW is instrumental in nutrient retention by capturing and storing salmon carcasses (Cederholm and Peterson 1985;

Strobel et al. 2009) and allochthonous materials, a primary energy source for smaller rivers and streams (Gregory et al. 1991). The resulting effect of LW on fish habitat is significant. Crispin et al. (1993) noted increased salmon spawning activity in an area where gravels accumulated behind LW. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of LW, and Fausch and Northcote (1992) documented that Coho salmon and cutthroat trout production was greater in LW-dominated streams, where pools, sinuosity, and overhead cover were greatest. The role of LW decreases as streams become larger, because greater currents will carry LW out of the active channel and onto the banks (Murphy and Meehan 1991).

iii. **Pool Frequency and Quality –** Pools are considered to be one of the most important habitat elements and are the preferred habitat type by most fish (Bestcha and Platts 1986), offering low velocity refuges, cooler stream temperatures during summer months, and overwintering habitat (Reeves et al. 1991). Salmonid density is positively correlated to pool volume and frequency; pool loss reduces the production capability of salmonid habitat (Everest et al. 1985; Sedell and Everest 1990; MacDonald et al. 1991; Nickelson et al. 1992a; Fausch and Northcote 1992; Reeves et al. 2011).

   Availability of pools during summer low flow periods can be a limiting factor in survival and production of salmonids (Reeves et al., 1990). In reference to spawning, pool tailouts, where gravel is deposited, are important areas for redd construction, and the pool bodies provide rearing habitat for juveniles and holding habitat for adults (Bjornn and Reiser 1991). Further, Sedell et al. (1990) describes pools as being important refuges from drought, fire, winter icing, and other disturbances. When pool numbers, volume, depth, and complexity increase, the stream's capacity to support a diversity of species and life stages increases (Bisson et al. 1992; Bjornn and Reiser 1991). In general, pool quality is directly related to decreased surface area and increased depth, overhead cover (Fausch and Northcote 1992), presence of LW, and undercut banks, especially in lower gradient streams. Further, pools of all shapes and sizes are needed to accommodate the various life history stages of fish, thereby allowing for juveniles to occupy pools absent of larger predatory fish (Bestcha and Platts 1986).

iv. **Off-channel Habitat –** Off-channel habitats—comprised of alcoves, side channels, freshwater sloughs, wetlands or other seasonally or permanently flooded areas—are important rearing sites for juvenile fish (Roni et al. 2002). Roni et al. (2002) noted that most off channel habitat research focused on coho salmon, noting that juveniles are much more reliant on this habitat type for over-winter rearing and growth than other salmonids, such as cutthroat trout and Chinook salmon. In an Oregon coastal stream, Reeves et al. (2011) noted that side channels comprised 5% of the total habitat but contained 20-60% of the coho fry in the study area.

v. **Refugia –** Refugia, or designated areas providing high quality habitat, either currently or in the future, are a cornerstone of most species conservation strategies. Although fragmented areas of suitable habitat may be important, Moyle and Sato (1991) argue that to recover aquatic species, refugia should be focused at a watershed scale. Naiman et al. (1992) and Sheldon (1998) noted that past attempts to recover fish populations were unsuccessful because the problem was not approached from a watershed perspective. Noss et al. (1997) provides additional information, listing several principals that should be considered when evaluating reserves (refugia). First, refugia should be well distributed across a landscape, the idea being that widely distributed subpopulations will not experience catastrophic or adverse impacts across its entire range. Some subpopulations will escape the impact, eventually re-colonize the affected area, and sustain the population as a whole. Second, large reserves are better than small ones, because there is a greater opportunity for habitat diversity and larger population size. As a result, genetic variability within a population will be optimized, promoting increased adaptability to environmental change. Thirdly, refugia that are closer together are better than those farther apart. A short distance between refugia promotes dispersion and genetic interchange. If enough interchange occurs between refugia, fish are functionally united into a larger population that can better avoid extinction.

b. Long-term Benefits of ARBA II Activities to the Habitat Elements Pathway – The following activity categories will provide immediate and long-term benefits to one or more of the Habitat Element indicators: Fish Passage Restoration; Large Wood, Boulder, and Gravel Placement; Dam, Tidegate, and Legacy Structure Removal; Channel Reconstruction/Relocation; Streambank Restoration; Set-back or Removal of Existing Berms, Dikes, and Levees; Reduction/Relocation of Recreation Impacts; Piling and other Structure Removal; Road and Trail Erosion Control and Decommissioning. Other ARBA II activity categories may not provide immediate benefits but will provide long-term benefits: Juniper Removal; Riparian Vegetation Treatment (controlled burning); Riparian Vegetative Planting; Beaver Habitat Restoration.

For instance, large wood and boulder placement will enhance habitat elements described in the Large Wood indicator, while Reconnection of Existing Side Channels and Alcoves will increase adult and juvenile rearing habitat as described in the Off-channel Habitat indicator above. Headcut stabilization, bank restoration, and road treatment projects will decrease direct sediment inputs into the stream channel, thereby enhancing conditions for juvenile rearing within channel substrate. Fish Passage Restoration projects will provide access to refugia while all restoration actions within the proposed action will enhance the quality of such refugia.

Short-term Negative Impacts of ARBA II Activities to the Habitat Element Pathway – As described above, restoration activity categories are expected to benefit Habitat Element indicators. In acquiring these benefits, short-term negative impacts are expected. Such effects will be minimized by incorporating Aquatic Conservation Measures (ACM) and Project Design Criteria (PDC) described above and can also be found in the Aquatic Restoration Biological Assessment II (ARBA II) in Chapter II; project design, implementation, and monitoring.

The ARBA II Team determined that negative impacts would occur to Substrate/Sediment. Further, the Team determined that all activity categories are known to increase short-term sediment loads into a stream channel during project implementation. Increased sediment loads would result from the use of large equipment within or adjacent to a stream channel, causing soil disturbance and transport within the stream system. The ARBA II Team also concluded that these activities are unlikely to have negative impacts to the remaining indicators of this pathway as ARBA II projects are intended to enhance such indicators. Therefore the following analysis will focus on activity affects to the Substrate/Sediment indicator.

Short-term inputs of sediment could result from instream structure placement, opening of side channels, road treatments, and other projects that occur inside or near the bankfull channel. The sediment plume from activities will be most concentrated in the immediate project vicinity and should dissipate throughout a stream channel within a few hours. The amount, extent, and duration of fine sediment inputs and turbidity are related to the following: the type and duration of heavy machinery used within or near a bankfull channel; soil type; the amount of soil disturbance; whether restoration is in or out of the wetted channel; the sensitivity of the channel banks to erosion and other disturbances; the amount of time it takes for disturbed areas to re-vegetate and stabilize; and the probability of precipitation events before disturbed areas are re-vegetated or stabilized.

The increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish to move downstream, and alter behavior patterns for a short time. Because the work will be conducted during the in-water work periods (a time when spawning is not expected and after emergence of fry), the project should not interfere with spawning, egg development, and the sac fry life stage. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct their redds. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term negative impacts to Substrate/Sediment are not expected.

4. **Channel Conditions and Dynamics Pathway**

a. **Indicator Description –** The descriptions of the following three pathway indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks: Width/Depth Ratio; Streambank Condition; Floodplain Connectivity.

i. **Width/Depth Ratios –** The width to depth ratio is an index value that helps describe the shape of a stream channel, and is the ratio of bankfull width to mean bankfull depth (Rosgen 1996). Both measurements are based on bankfull flow or its indicators. In short, bankfull flow is the channel forming flow that transports the bulk of available sediment over time. In another way, bankfull flows are those that transport sediment from upstream reaches, forming and removing channel bars, doing the work that forms the morphological characteristics of a channel (Dunne and Leopold 1978). Relatively small width/ depth values are indicative of stream stability, and Rosgen (1996) suggests that width to depth ratios can be used as a surrogate to stream stability. Finally, Bestcha and Platts (1986) state that as width to depth ratios increase, the stream becomes shallower and may result in a loss of pools.

ii. **Streambank Condition –** Streambank condition is related to its ability to dissipate stream power. For many stream channels, riparian vegetation with woody root masses, along with instream debris, serve as physical barriers to erosive and downcutting forces of stream power (Bestcha and Platts 1986). Further, the stems of herbaceous and woody plants, residing on the stream bank, provide additional roughness to dissipate stream power and capture suspended sediments (Elmore and Bestcha 1987). When these roughness elements are removed, however, a streambanks ability to withstand stream power is decreased, resulting in bank erosion, relatively higher width to depth ratios, and possible channel incision. Even if streambanks are in good condition, increased peak flows can damage banks and cause channel incision. Finally, streambanks that are in good condition can provide quality fish habitat through undercut banks and overhanging vegetation (Bestcha and Platts 1986; USDI 1998c).

iii. **Floodplain Connectivity –** Leopold (1994) defines a floodplain as a level area near a river channel, constructed by the river in the present climate and overland flow during moderate flow events. When a stream can readily access its floodplain during high flow events, the stream will overflow its banks and spread across the floodplain, dissipating stream energy, depositing sediments, accessing side channels. Bestcha and Platts (1986) suggest that for a floodplain to be effective in sorting and capturing flood-born sediment it must have roughness elements, such as trees and other debris. Floodplains or riparian areas adjacent to stream channels serve as water storage sites—water collected from flooding and precipitation—which can increase subsurface flow to the stream channel (Elmore and Bestcha 1987), especially important to augmentation of low stream flows during summer months. Likewise, Tonina and Buffington (2009) note that floodplains that are connected to stream channels result in hyporheic exchange of water, resulting in increased nutrient distribution and increased inundation of floodplain habitats, such as side channels, a habitat type offering refuge to juvenile salmonids during high flow events (Roni et al. 2002).

b. **Long-term Benefits of ARBA II Activities to the Channel Condition and Dynamics Pathway –** All projects will enhance one or more of the indicators under the Channel Condition and Dynamics Pathway. Each of these projects will occur within the bankfull channel and/or immediate floodplain area and are intended to restore channel, bank, and floodplain areas to more natural conditions. As a result, ARBA II projects are expected to decrease width/depth ratios, improve streambank condition, and/or increase floodplain connectivity.

c. **Short-term Negative Impacts of ARBA II Activities to the Channel Condition and Dynamics Pathway –** As described above, restoration activity categories are expected to benefit Channel Conditions and Dynamics. In acquiring these benefits, the ARBA II Team determined that activity categories will not result in negative impacts to any of the three pathway indicators as no projects will increase width/depth ratios, decrease streambank condition, and disconnect floodplains.

5. Flow Hydrology Pathway

a. **Indicator Descriptions –** The descriptions of the following two pathway indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks: Changes in Peak/Base Flows and Increase in Drainage Network.

   i. **Changes in Peak/Base Flows** – Many riparian wetlands, such as wet meadows, have been damaged by grazing, mining, road construction, and logging in the analysis area as consistently indicated by field reviews (Beschta et al., 1991). This loss of wetland function has probably contributed to a reduction in summer low flows relative to historic conditions. Although data are sparse, peakflows may occur a week or two earlier in the year in some managed watersheds year than in unmanaged watersheds. McIntosh (1992) found that the annual peakflows currently occur about 2 weeks earlier in the Grande Ronde than historically. Some heavily logged drainages may have increased summer low flows; summer low flow has increased in the some parts of the Grande Ronde over the past 50 years (McIntosh, 1992). However, the increases in low flows do not appear to have improved salmonid survival because the water quality is so poor and stream habitats have been heavily degraded due to upstream logging, grazing, and road construction (Anderson et al., 1993; McIntosh et al., 1994).

   ii. **Increase in Drainage Network –** Wemple et al. (1996) documented that 57% of a road system within a watershed, located in the western Cascades of Oregon, was hydrologically connected to the stream network by roadside ditches draining directly into streams and roadside ditches draining into relief culverts with gullies below their outlets. Thus, an increase in road densities led to an associated increase in drainage density by up to 50%. High-density road systems have been linked to changes in the hydrograph or magnitude and timing of flow events. For instance, in an Oregon Coast Range watershed, Harr et al. (1975) showed that peak flows increased significantly after road building converted at least 12% of the area to road prisms. The causal effects were attributed to increased surface compaction, which reduces water infiltration, resulting in excess water being carried down the road, drainage ditches, and relief culverts into the stream network. Jones and Grant (1996) documented that peak flows increased by 50%

in a watershed within a five year period following road construction and logging. The longevity of the hydrologic changes are as permanent as the roads, and until a road is removed and natural drainage patterns are restored, the road will continue to affect the routing of water through a watershed.

b. **Long-term Benefits of ARBA II Activities to the Flow/Hydrology Pathway –** Numerous ARBA II activity categories will provide immediate benefits to the Flow/Hydrology Pathway: Large Wood, Boulder, and Gravel Placement; Channel Reconstruction/Relocation; Off- and Side-Channel Habitat Restoration; Set-back or Removal of Existing Berms, Dikes, and Levees. Each of these projects will enhance floodplain connectivity, thereby addressing wetland functions described under Peak/base Flows above. Road and Trail Erosion Control and Decommissioning will provide additional benefits in that they will reduce the drainage network, thus addressing issues discussed in the Drainage Network category above.

c. **Short-term Negative Impacts of ARBA II Activities to the Flow Hydrology Pathway –** As described above, restoration activity categories are expected to benefit Peak/base Flows and Drainage Network categories. In acquiring these benefits, the ARBA II Team determined that activity categories will not result in negative impacts to any of the two pathway indicators as no projects will not disrupt natural peak/base flow patterns or increase the drainage network.

6. **Watershed Condition Pathway**

a. **Indicator Description** – The descriptions of the following three MPI Indicators provide the ways in which each indicator serves as an essential ecological function necessary for the overall viability of fish stocks: Road Density and Location, Riparian Reserves, and Disturbance History.

i. **Road Density and Location –** Available information consistently indicates that roads are one of the greatest sources of habitat degradation in managed watersheds, especially when they are within riparian zones (Geppert et al., 1984; Furniss et al., 1991). Roads significantly elevate on-site erosion and sediment delivery for the life of the road (Geppert et al. 1984). Studies consistently indicate that roads increase the frequency of mass failures in mountainous terrain (Dunne and Leopold, 1978; Geppert et al., 1984; Furniss et al. 1991). Mass failure volumes from roads are orders of magnitude greater than from undisturbed areas on a per unit area basis (Dunne and Leopold, 1978; Geppert et al., 1984; Furniss et al., 1991). Road crossings cause extreme increases in sediment delivery (Fowler et al., 1987). Roads also disrupt subsurface flows (Megahan, 1972). Roads increase peakflows (King and Tennyson 1984). Roads within riparian zones reduce shading and disrupt LWD sources for the life of the road. These effects of roads degrade habitat by increasing fine sediment levels, reducing pool volumes, increasing channel width and exacerbating seasonal temperature extremes.

ii. **Riparian Areas –** The following discussion was adapted from FEMAT (1993). Riparian areas are those portions of watersheds that are directly coupled to streams and rivers, the portions of watersheds required for maintaining hydrologic, geomorphic, and ecological processes that directly affect streams, stream processes, and fish habitats. The network of Riparian Reserves—comprised of all stream orders both intermittent and perennial—allow for connectivity of the aquatic ecosystem within a watershed. Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflows, deposition by floods and debris flows. The near-stream riparian areas—floodplains—may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides allochthonous (organic debris) to stream channels and associated aquatic invertebrate communities.

Further, riparian vegetation moderates light levels and stream temperature, helps armor stream banks with extensive root systems, and contributes large wood into the stream channel.

iii. **Disturbance History –** Information for this section was acquired from Reeves et al. (1995). Even though the article was directed at anadromous salmonids, the discussion can readily apply to most PNW fish stocks. Riverine-riparian ecosystems within the PNW used by anadromous salmonids naturally experience periodic catastrophic disturbances, which then moved through a series of recovery states over a period of decades to centuries, resulting in a landscape that varies in suitability for salmonids. Disturbance can be categorized as being pulse or press disturbances. A pulse disturbance is one that allows an ecosystem to recover to pre-disturbance conditions, and a press disturbance is one that prohibits an ecosystem from rebounding to pre-disturbance conditions. The dominant pulse disturbances in which the PNW salmonids are adapted to include natural fire regimes, fire related landslides, and floods, all working in concert in a manner that produce habitat patches, varying in quality and quantity. In short, fires would burn through an area, landslides would then transport wood and sediment into the streams, and floods would distribute the sediment and debris throughout stream networks. In the Oregon coast range, the amount of sediment and large wood found in streams could be correlated to occurrence of the last stand replacement fire. This pulse disturbance regime, or varying forms thereof, was altered with the onset of fire suppression and extensive timber harvest. The resulting effects are different from the natural pulse regime in that sediment is transported in the system without wood, the interval between disturbances has been drastically reduced in most cases, and harvest and road construction is widely distributed, resulting in chronic sedimentation across a larger landscape.

b. **Long-term Benefits of Restoration Activities to the Watershed Condition Pathway –** Several activity categories are expected to provide immediate and long-term benefits to the Watershed Condition Pathway: Dam, Tidegate, and Legacy Structure Removal; Channel Reconstruction/Relocation; Off- and Side-Channel Habitat Restoration; Streambank Restoration; Set-back or Removal of Existing Berms, Dikes, and Levees; Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering; Road and Trail Erosion Control and Decommissioning. Other ARBA II activity categories may not provide immediate benefits but will provide long-term benefits: Juniper Removal; Riparian Vegetation Treatment (controlled burning); Riparian Vegetative Planting; Beaver Habitat Restoration.

All of these activities will promote growth of riparian vegetation, thus improving riparian conditions as described under the Riparian Area category. Road treatment projects will reduce the potential for negative impacts as described in the Road Density and Location category as well as restoring processes that would occur under a more natural disturbance regime. Riparian Vegetation Treatment (controlled burning) is intended to mimic and promote the recovery of fire-based natural disturbance regimes, while Road and Trail Erosion Control and Decommissioning projects will help transform disturbance regimes from a press to a pulse regime.

c. **Short-term Negative Impacts of ARBA II Activities to the Watershed Conditions Pathway** – proposed action activity categories are expected to benefit Watershed Condition indicators. It is anticipated that no adverse effects are expected to occur to the three indicators as no projects will increase road density, increase press disturbance regime processes, or degrade riparian conditions.

Alternative 2 – Cumulative Effects

Cumulative effects are the result of incremental impacts of the proposed actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on National Forest System lands and adjacent federal, state, or private lands (40 CFR 1508.7). The baseline for cumulative effects analysis is the current condition as described in the affected environment section above.

All restoration activity categories (except for In-Channel Nutrient Enhancement, Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration activity categories) will result in negative impacts to the Turbidity and Substrate/Sediment Indicators in proximity to RFSSL species, MIS, ESA listed fish species and within designated CH. The sediment plume from restoration activities will be most concentrated in the immediate project vicinity and should dissipate in the stream channel within in a few hours. The increased stream turbidity may deposit fine coats of sediment on channel substrate a short distance downstream. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and substrate/sediment, including spawning gravels, are not expected.

A list of forest wide projects are scheduled to occur 2018 and beyond that will be concurrent with the proposed action. These projects include but are not limited to: prescribed burning, commercial timber harvest, plantation thinning, small diameter thinning, replacing road culverts, road maintenance, road decommissioning, recreational mining, aspen release, juniper thinning, toilet replacement, gate replacement, fencing and grazing and other various and related activities.

Based on this analysis and professional judgment, potential project effects would represent a very small percentage of the total (cumulative) from all actions combined. Natural background seasonal fluctuation along with sediment/turbidity effects from other actions (e.g., roads, timber harvest, grazing) exceeds any potential production from the proposed restoration activities. Sediment production from project actions could add to sources derived from other actions on National Forest System lands, tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property.

Within specific 6th field sub-watersheds where project-related sediment/turbidity effects could potentially exceed the "discountable" threshold, effects are low magnitude and short term. Streams listed (303(d)) (See affected environment) for sediment/bio criteria within the Umatilla National Forest are not expected to incur any detectable long-term sediment additions from project activities; spatially isolated short-term sediment effects would be limited to low-magnitude turbidity increases. These effects are also not of a type or extent that would combine with ongoing human activities or foreseeable projects on the Forest and produce long-term, cumulative impacts.

Overall, it is assumed that the temporary and short-term effects from restoration activities would not compromise the benefits of restoration, and thus, water quality (sediment and temperature) across the Forest is expected to improve as projects are implemented to restore healthy, functioning watersheds and their associated aquatic ecosystems.

Summary

Federally Listed Fishes and their Designated Critical Habitat

For federally listed species (chinook, steelhead and bull trout) and essential fish habitat (Chinook salmon), the potential for adverse effects was determined to exist for the Resource Indicator Sediment. Although effects (sediment/turbidity) from these activities are expected to be minor and short term, they could exceed the "discountable" threshold, and are therefore likely to adversely affect fish and their designated habitat. Consultation was completed with U.S. Fish and Wildlife Service and the National Marine Fisheries Service in 2013 for all of the proposed restoration project categories. Both the National Marine Fisheries Service (USDI NMFS 2013) and US Fish and Wildlife Service (USDI FWS 2013) have completed consultation.

Additional Section 7 ESA consultation will occur with the local Umatilla Level 1 Section 7 ESA team[3] and through the pre-notification database Aquatic Restoration Regulatory Reporting System (ARRRS). The Level 1 review and ARRRS electronic pre and post project notification are requirements and assure projects included in the Umatilla National Forest Aquatic Restoration EA will meet ESA Section 7 obligations.

Forest Service Regional Forester Special Status and Sensitive Species

Forest Service Sensitive species (Columbia clubtail, Pacific Lamprey, redband trout, western ridge musse, Shortface lanx, westslope cutthroat trout and Pristine springsnaill) exhibit largely overlapping ranges and similar vulnerability to effects with the federally listed fishes; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area."

Forest Service Management Indicator Species

Forest Service Management Indicator Species (MIS) redband trout overlap the distribution of federally listed fishes, and exhibit similar vulnerability to effects. In summary, there would be no reduction in quantity (miles) of stream habitat due to project actions. Habitat quality may be slightly reduced in the short-term due to post-implementation sediment input resulting from restoration activities. This potential effect would occur within a fraction of available habitat; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area." In the long term, near-stream conditions would be improved as restoration actions are completed.

Table 17: Summary Determination of Effects from Alternative 1 and 2 on Aquatic Species and Designated Critical Habitat for ESA, RFSSSL and MIS species on the Umatilla NF.

Species	Listing Status	Alternative 1 Effects Determination	Alternative 2 Effects Determination
Columbia River Bull Trout and DCH	ESA T	NE	LAA
MCR Steelhead and DCH	ESA T	NE	LAA
SRB Spring/summer Chinook and DCH*	ESA T	NE	LAA
SRB steelhead and DCH*	ESA T	NE	LAA
Inland Columbia Redband Trout	MIS and RFSSL	NI	MIIH
Westslope cutthroat trout	RFSSL	NI	MIIH
Pacific Lamprey	RFSSL	NI	MIIH
Western Ridged Mussel	RFSSL	NI	MIIH
Shortface Lanx	RFSSL	NI	MIIH
Westslope Cutthroat Trout	RFSSL	NI	MIIH
Columbia clubtail	RFSSL	NI	MIIH
Pristine springsnail	RFSSL	NI	MIIH

[3] Umatilla Level 1 interagency team composed of representatives from USFS, NMFS, FWS and Bureau of Land Management

[*] *Determination for Chinook salmon waters designated Essential Fish Habitat is NI for Alternative 1 and No Adverse Impact for Alternative 2.*

Acronyms for Effects Determinations

NE	No Effect
NLAA	May Effect, Not Likely to Adversely Affect
LAA	May Effect, Likely to Adversely Affect
NI	No Impact
MIIH	May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
WIFV	Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI	Beneficial Impact

ESA Recovery Plans for Aquatic Species

Under Section 7 (a) 1 of the Endangered Species Act, the Umatilla National Forest, as a federal agency, utilizes its authority in furtherance of the purposes of the ESA by carrying out programs for the conservation of listed endangered species and threatened species. Recovery plans have been developed for ESA listed aquatic species on the Umatilla NF: Middle Columbia River steelhead (NMFS 2009), Snake River steelhead and chinook salmon (NMFS 2017) and bull trout (FWS 2015). Recovery plans identify actions needed to restore threatened and endangered species to the point that they are again self-sustaining elements of their ecosystems and no longer need protection. Recovery plans are guidance, and identify limiting factors for ESA listed species.

NMFS recovery plans for steelhead and chinook identified limiting factors across the Umatilla NF. Examples included altered hydrology and sediment routing, along with degraded floodplains, riparian communities, stream channel structure, and water quality (temperature).

The Columbia River Bull Trout Recovery Plan identified limiting factors for bull trout across the Umatilla NF. Examples include altered hydrology and sediment routing, aquatic passage, degraded floodplains, riparian communities, stream channel structure, water quality (temperature), and introduction of non-native species.

Actions described in this document meet the intent and are consistent with the Recovery Plans described above.

Compliance with the Forest Plan and Other Direction

Water Quality Management Plans (WQMP) covering US Forest Service lands rely on current laws, management plans, and BMPs to provide the basis for improving water quality in the forested landscape. All federal land management activities must follow standards and guidelines found in the Umatilla National Forest Plan, as amended by PACFISH (USDA and USDI 1995b). PACFISH provides management direction in the form of interim Riparian Habitat Conservation Areas (RHCAs) and Standards and Guidelines.

The anti-degradation EPA policy 40 C.F. R. Section 131.12 states that existing water quality, even when it exceeds required levels for stated beneficial uses will be maintained. Potential effects of the proposed action, either through surface runoff of sediment and chemicals or chemicals entering water bodies through groundwater sources do not constitute a significant degradation of quality or impair existing beneficial uses.

This project is also consistent and compliant with the Clean Water Act, 1977 and the Water Quality Act of 1987. Potential effects of the proposed action do not constitute a significant degradation of quality or impair existing beneficial uses, either through surface runoff of sediment and chemicals or chemicals entering water bodies through groundwater sources.

All land management activities on USFS lands are to be conducted in accordance with Forest Plan standards and guidelines and BMPs. Use of water quality and other resource protection BMPs in National Forests is required by the National Forest Management Act (NFMA) and prescribed in the Forest Plans. Consequently, all land management activities, must be implemented using BMPs for control of non-point source water pollution (USDA 2012).

The Aquatic Restoration EA was prepared to disclose and analyze effects of the project on ESA (Endangered Species Act) listed species and their designated critical habitat in accordance with the following guidance and direction:

- Section 7(a)(2) of the Endangered Species Act of 1973 (as amended),
- 50 CFR § 402.12 (Interagency Cooperation, Biological Assessments),
- Endangered Species Consultation Handbook (USFWS and NMFS 1998),
- Streamlined Consultation Procedures for Section 7 of the Endangered Species Act (FS, NMFS, BLM and USFWS 1999)

Alternative 2 is consistent with the ESA and Forest Plan direction regarding native fish populations. Alternative 2 was designed to meet all water quality regulatory requirements for the UNF. Given these Forest Service requirements, none of the potential direct/indirect/cumulative effects would prevent attainment of PACFISH Riparian Management Objectives or steelhead/redband and bull trout trout population viability. Application of PACFISH direction would maintain or improve fish habitat conditions in the analysis area; therefore there would not be adverse modifications to critical habitat or adverse effects to listed fish, as per applicable PACFISH objectives and guidelines.

Other Agencies and Individuals Consulted

National Marine Fisheries Service – Issued Aquatic Restoration Biological Opinion (April 25, 2013)

US Fish and Wildlife Service – Issued Aquatic Restoration Biological Opinion (July, 2013)